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LIFE-HISTORIES OF THE NEW YORK SLUG CATERPILLARS.—VII–IX.

By Harrison G. Dyar, A.M., Ph.D.

PLATES I-II.

Tortricidia fasciola *Herrich-Schæffer.*

1854—*Limacodes fasciola* Herrich-Schæffer, Ausser. Schmett. fig. 186.
1860—*Limacodes laticlavia* Clemens, Proc. Acad. Nat. Sci. Phil. XII, 157.
1864—*Lithacodes fasciola* Packard, Proc. Ent. Soc. Phil. III, 345.
1882—*Limacodes fasciola* Grote, Check List, 17.
1886—*Lithacodes laticlavia* Hy. Edwards, Ent. Amer. II, 9.
1891—*Limacodes fasciata* Smith, List Lep. 28.
1892—*Lithacodes fasciola* Kirby, Cat. Lep. Het. I, 555.
1894—*Tortricidia fasciola* Neumoegen & Dyar, Journ. N. Y. Ent. Soc. II, 76.

Larva.

1860—Clemens, Proc. Acad. Nat Sci. Phil. XII, 157.
1872—Lintner, 26th Rept. N. Y. State Cab. Nat. Hist. 149.
1883—Saunders, Ins. Inj. Forest Trees, 179.
1893—Packard, Proc. Am. Phil. Soc. XXXI, 101.
1894—Dyar, Ann. N. Y. Acad. Sci. VIII, 221.

Special Structural Characters.

Dorsal space broad, flat, narrowing to the ends in a short rounded margin, gently arched; lateral space broad, oblique, slightly concave, narrowing to the ends; subventral space small, retracted. Subdorsal ridge slight, angulated, smooth at maturity, the tubercles disappearing during ontogeny and finally the setæ also. Lateral ridge moderately prominent, also smooth at maturity. Head and joint 2 well retracted. Segments unusually distinct, the incisures marked, cleft-like. Dorsal outline elliptical, joint 13 forming a broad quadrate termination. Depressed spaces (1) to (8) present, deep, but not large, the margins

rounded, not sharply defined; (4) is evidently situated in the incisure on the posterior edge of its corresponding segment. (1) and (4) are the largest and have distinct dark centers, both transversely elongated. Skin granules large, rounded, contiguous, rather confused and irregular so that the surface appears creased and coarsely shagreened rather than covered with distinct granules. In stage I the setæ are arranged as in *Apoda y-inversa* and have the same structure. Their course of reduction in the later stages is also the same. The skin granules when first appearing are of two forms, numerous fine ones and a few larger ones which form short spines on the ridges. These persist till the last stage, when the granulation is rendered uniform, but confused.

The coloration is a light yellowish green, marked obscurely with yellow, adapted to the color of the leaves it feeds on.

AFFINITIES, HABITS, ETC.

This larva is nearly allied to *Apoda y-inversa* and to what I now think is *A. biguttata*, * also in a less degree to the Packardias. It differs from these in the peculiar granulation. In referring the species to *Tortricidia*, the characters of the moth alone were considered. On the whole the species seems not strictly congeneric, phylogenetically, with either *Apoda* or *Tortricidia*, and the name *Lithocodes* would be justified, if any good characters could be found in the moth. From *Tortricidia pallida* and *Heterogenea flexuosa* (?) this larva differs in the slight development of the depressed spaces which are as in *Apoda*. The shape is similar in both.

T. fasciola ranges to the north, probably as far as *T. pallida* and it also ranges well to the south. It is an abundant species in New York, the larvæ always well separated and living on a variety of plants, for the most part low. Occasionally the larvæ will be found on very low shrubs. They are not particular as to the position of their food plant in regard to light, being found in open as well as dark woods. The small eggs are laid singly on the backs of the leaves in July and the larvæ mature in September. There are seven larval stages, occasionally eight, the larvæ feeding in stage I, as in all the smooth Eucleids. †

A newly hatched larva was found by me on wild cherry and carried through to maturity. I am indebted to Miss Morton for fertile eggs, from which also I followed out the life history.

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* Described as *Apoda y-inversa*, Ann. N. Y. Acad. Sci. VIII, 221.

† Our statement to the contrary in the case of *Apoda y-inversa* is an error.

CRITICISM OF PREVIOUS DESCRIPTIONS.

Dr. Packard's description is the only one of importance. His figure of Stage I is not drawn in a detailed manner, many of the setæ being omitted or incorrectly drawn. The description is like the figure, but is not corroborated by my observations. I think the setæ at the extremities were not carefully examined, and the spiracles have been put in in the wrong place. The lowest row of short setæ in the figure probably represents the subventral row, not shown in my figure (Plate I, Fig. 1) and the spiracles should be above it. Besides stage I, Dr. Packard describes the last three stages, V, VI and VII (marked III?, IV? and "last stage"). I find the descriptions excellent. The dorsal and lateral depressed spaces are quite fully described and located, though the upper segmental lateral (3) are said to be situated "on a suture"* which is not the case. I also object to the centers of the dorsal depressions (1) being called warts, and the broken yellow line along the lateral ridge being described in the same series as the lateral depressed spaces.†

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Elliptical, narrower than usual, not greatly flattened, the upper surface arched; size .7 × .5 mm., height about .2 mm. and therefore unusually high in proportion. Reticulations obscure, irregularly hexagonal, linear. Color whitish translucent with a very faint yellow tint. They hatch in eight days.

Stage I. (Plate I, Fig. 1).—Head whitish, eye black, mouth brown. Body highest at joints 3–4, rather square. Setæ arranged as in *Apoda y-inversa* and with the same structure, colorless. Body all whitish, without marks. The subdorsal setæ on joints 5, 7, 9 and 11 lean out, alternating with the others; all have expanded cleft tips, the subdorsals on joints 4 to 12 with a short spur near the base. The lateral setæ on joint 5 leans upward more than the others. After eating, the blood becomes pale green and the dark alimentary canal shows by transparency. Length .7 to 1.1 mm.

Stage II.—Elliptical, tail squarish; dorsal space broad, lateral moderate, subventral small; ridges prominent, tubercular; two setæ on

* "On each of the lateral slopes of the plateau are four rows of lemon yellow spots, the highest and first being a row of minute transverse spots situated on the suture."

† "The *fourth row* is on the margin of the body, and is a broken series of short lines."

subdorsal ridge, one on lateral ridge of abdomen (Plate I, Fig. 4), a secondary setæ above the spiracle and the two of subventral row below it. Upper setæ long, stiff, black at apex. Skin with sparse granules produced into slender spines, longest and most numerous along the ridges at the bases of the setæ; a few distinct spines in the dorsal space, but in the lateral area mostly fine granulations only. Color translucent pale greenish, no pigment. Segments well marked. Length 1 to 1.6 mm.

Stage III.—Body moderately elongated, elliptical, more elongated than *T. pallida*. Skin very finely granular, frosted under a half-inch objective, which hardly resolves the fine granules; conical, clear, pointed tubercles, much larger than the granules, are distributed in a single row along the low, rounded latticed ridges, becoming pale secondary spines on the tubercles. Tubercles low and rounded, the subdorsal ones with two, lateral with one large, dark, stiff setæ. Ridges prominent, normal. Color pale green, alimentary canal dark. Toward the end of the stage a faint yellow line appears along the subdorsal ridge and yellow dots in the dorsal depressed spaces (1); all the depressed spaces faintly shown. Length 1.5 to 2.6 mm.

Stage IV.—Ridges well marked, tubercular, setæ black. Tail quadrate, composed of the last abdominal segment. Depressed spaces as in *T. pallida*, but ill defined, the separating latticed ridges obscure. Skin finely granular, the larger spinose granules few in number except on the ridges. Color light green, dorsum dark, translucent. A narrow yellow line below the subdorsal ridge, a series of yellowish dorsal rings in the depressed spaces (1), seven of them distinct; a row of lateral whitish spots (4). Length 2.5 to 4 mm.

Stage V.—Elliptical, tail quadrate, dorsal space moderate, lateral broad, oblique, subventral small, retracted. Ridges only slightly tubercular. Latticed ridges low, with both coarse and fine granules as before, the former becoming pale spines on the ridges, especially the lateral one (Plate I, Fig 5). Color yellowish green, a narrow, wavy, yellow, subdorsal line; yellow rings in depressed spaces (1), two yellow dashes in (4), separated by a green spot; the other depressions show as yellow dots. There may be a distinct dark green spot between spaces (1) and (2) in certain larvæ. Length 3.5 to 6.7 mm.

Stage VI.—(Plate I, Figs. 2 and 3.) Ridges slightly tubercular with distinct black setæ, but without secondary spines; shape elliptical, the tail quadrate as in the mature larva. Skin confused granular, the granules resulting from the two kinds of the former stage, alike now except in size, somewhat flattened in the dorsal space and irregular. Yellow-

ish green, a narrow, slightly wavy subdorsal yellow line, free at the ends; depressed spaces (1) to (6) yellow, (1) green centered, (4) bisected by green, (6) above the lateral ridge, nearly divided by the incisure; traces of a white subventral line and a broken yellow one on the lateral ridge. Length 5 to 7.7 mm.

Stage VII.—(Plate I, Fig. 6.) Smooth, the setæ absent; shape as described. Depressed spaces moderately developed, without sharp edges. Skin granules irregular, confused. Color yellowish green, dorsal space and upper half of lateral space pigmented, below more translucent. Subdorsal line yellow, narrow, waved by slightly darker green segmental dots above; lateral line broken, faint, all joining on joint 13, the subdorsals also on joint 3 anteriorly. Subventral edge white. Depressed spaces (1) to (6) pale yellow, (1) and (4) plainly green centered. Length 7 to 13 mm.

Food-plants observed.—Wild cherry, white birch, bayberry, dogwood, chestnut, sugar plum, oak, linden, maple, beech, hop hornbeam, hickory and huckleberry.

Adoneta spinuloides *Herrich-Schæffer.*

1854—*Limacodes spinuloides* Herrich-Schæffer, Ausser. Schmett. figs. 187, 188.
1860—*Adoneta voluta* Clemens, Proc. Acad. Nat. Sci. Phil. XII, 158.
1864—*Cyclopteryx leucosigma* Packard, Proc. Ent. Soc. Phil. III, 345.
1865—*Limacodes ferrigera* Walker, Cat. Brit. Mus. pt. XXXII, 486.
1882—*Adoneta spinuloides* and *leucosigma* Grote, Check List, 17.
1894—*Adoneta spinuloides* and *leucosigma* Neumoegen & Dyar, Journ. N. Y. Ent. Soc. II, 71.

LARVA.

1860—Clemens, Proc. Acad. Nat. Sci. XII, 158.
1882—Ballard, Papilio, II, 83.
1883—Edwards & Elliot, Papilio, III, 129.
1892—Beutenmüller, Bull. Am. Mus. Nat. His. IV, 68.
1893—Packard, Proc. Am. Phil. Soc. XXXI, 92.
1894—Dyar, Ann. N. Y. Acad. Sci. VIII, 213.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space moderately broad, narrowing to the ends, lateral and subventral spaces both moderate, subequal, the latter scarcely retracted. Body elongate, narrow, rising rather rapidly to joint 5, thence sloping to joint 13. Ridges all slight, subdorsal indicated by change in direction between back and sides, lateral very slight, the row of horns forming most of it. Horns short and small, rounded, the subdorsals on joint 3 to 5 and 11 the largest, those on 8 and 13 next, the rest all

quite small. Skin densely and coarsely covered with subconic clear granules, uniformly and without distinct depressed spaces, (1) indicated by paired white dots in a slight intersegmental furrow, (3) just indicated, whitish, (4) as faint pale rings. In the subventral space large rather indistinct hollows (7) alternate with the spiracles, forming perpendicular segmental ridges, reaching to the subventral edge. Caltropes are present in the last stage only, in little patches on top of the lateral horns on joints 6 to 11 and large patches on lateral of 12 and subdorsal of 13.

The first stage does not differ from that of *Euclea delphinii* and the mature larva, though differing in shape, is also adapted for concealment by its coloration. Its defensive armor is even more reduced than in the *Euclea* mentioned.

AFFINITIES, HABITS, ETC.

In the shortened horns the larva closely resembles *Euclea delphinii*. It is more generalized than this species since there are no detachable spines and the bright colors remain. It is more specialized than *E. indetermina* in the shortening of the horns and the alteration in shape, which resembles *Parasa chloris*, except in the absence of a tail. Our two Eucleas, the *Parasa* and *Adoneta*, form a closely allied group.

The eggs of *Adoneta* are laid in July and the larvæ mature in September as usual. The larva is a low feeder and, as several eggs are not infrequently laid at once, several larvæ are usually found on the same plant. The bright colors of the larva possibly have little warning effect as the spines are nearly functionless; but they may serve rather as in the smooth Eucleids to suggest patches on the leaves.

I am indebted to Miss Morton for the eggs of this species. She has also furnished the material for Dr. Packard's descriptions and thus our present knowledge of this life history is entirely dependent upon her.

CRITICISM OF PREVIOUS DESCRIPTIONS.

Though there are but few references to this larva, it may be said to be well known, owing to the early date of Clemens' writing and to Dr. Packard's very full and excellent account. In my description the lateral horns are located below the spiracles; the true position is given by Edwards & Elliot. Mrs. Ballard's "strap-shaped lines, buttoned at either end," are to be interpreted as transverse streaks between the paired dots of depressed spaces (1). Dr. Packard describes the "whole life history" in five stages. There are really seven, and Dr. Packard has doubtless been misled by a too hasty generalization from observations of the Notodontidæ. The stages which he gives seem to be I,

III,* IV, VI and VII, which illustrates the life history very well, though it is not a complete account of it, as it purports to be. The description and figure of stage I are in error in placing a lateral horn on joint 5. In stage "IV" (=VI) the paired glandular dots (1) are again called "warts," and in the last stage he says "these dots appear to be modified surface dorsal piliferous warts . . ." I do not think they are. The appearance is glandular and I have seen in *T. fasciola* a small drop of moisture in the location of each one of these depressed spaces which I believe was the secretion, not at the time evaporated. Besides, all the normal primary warts are situated elsewhere, and there are no warts, primary or secondary, in the whole order Lepidoptera in such a position (in the incisures). That they are not secondary warts is indicated by the fact that they are not more distinct in the early stages and never bear any setæ, as would be expected if they were degenerate warts.

Dr. Packard regards *Adoneta* as one of the more generalized forms of its group, and with this I agree, though I think it is not so generalized as *Euclea indetermina*. He says: "This larva indicates in some points of its structure its descent, and that of the group to which it belongs, from the Attacinæ; these points are the setiferous tubercles and the distinctness of the segments from one another, the sutures being well marked."

Recently Dr. Chapman also falls in with this view. He says (Trans. Ent. Soc. London, 1896, p. 584): "My observations on the spines of *Limacodes* and *Eacles*, and again of these and Sphinges and Saturnids . . . . and the observations of Poulton and Weissman, on the larvæ of *Aglia*, Sphingidæ, etc., leave no room for doubt that all these families are related . . . ." The question of the relation between the Sphingides and Saturniides, which Poulton, Weissman and Müller discuss, is aside from the present matter, and cannot be answered with the same certainty till some more generalized Sphingidæ are found. But the relationship which is claimed between the Eucleidæ and Saturniides on account of the spines, seems to me of exactly the same nature as that between the species of *Apatela* and the several families in which Mr. Butler once distributed them, based with equal probability on the similar structure of the hairs.†

* Mr. Bridgham is quoted as stating that this stage was drawn "after the first molt." However, I imagine that the true first molt escaped his observation, as I do not suppose he was looking for a molt before the larva had eaten anything.

† The stinging spines of the Saturnians (Hemileuca, etc.) are not ancestrial to the whole group, nor are they so in the Eucleidæ, which I expect to illustrate in a genealogical tree to be given at the end of these articles.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Elliptical, flat, 1.1 × .7 mm., milky whitish when laid on glass, reticulations obscure. Laid singly or in patches of two to ten, slightly overlapping. They hatch in seven days.

Stage I.—(Plate I, Fig. 8) Structure as in Euclea; eleven horns in subdorsal row, nine in lateral row, the one on joint 5 absent. Three setæ on each horn, tapering, slightly enlarged and notched at the tips. Color uniform, translucent whitish; skin smooth; head white, eye black. Length .9 mm. The larva does not feed in this stage and molts in two days from the time of hatching.

Stage II.—Head white, eye black, mouth brown; horns spined, the long subdorsals, with a bunch of black-tipped spines, the short ones with one spine; lateral row moderately spined. Color opaque whitish; dorsal depressed spots (1) paired, greenish, two pair on the incisures 3-4 and 4-5, those on interspaces 8-9 and 9–10 connected into a transverse streak. No marks except a white line along the subdorsal ridge. Length, .9 to 2.2 mm.

Stage III.—Thickest through joints 4–5; dorsum flat, sides nearly perpendicular; lateral ridge moderate, shape as in the mature larva. Subdorsal horns on joints 3, 4, 5, 8, 11 and 12 large, rounded, not long, the others very small, but with several spines, lateral horns all small. Color whitish, dorsum and upper half of sides green from food; a white subdorsal line, thickened at the large horns, causing the dorsal space to widen and contract. In the wide spaces on joints 4–5 and 6–7 a rounded patch of pale purplish pigment, and in the space 9–10 a smaller whitish patch. Skin finely clear granular except on the horns. Dorsal dots (1) white. Later all the dorsal patches become purple-red and there is another on joints 3–4; subdorsal horns faintly yellowish. Length, 2.1 to 3.3 mm.

Stage IV.—Structure as in the mature larva. Skin clear granular, the paired white dots (1) visible where the ground color is purple. Markings at first as at the end of the last stage; later the subdorsal horns on joints 3 to 5 are tipped with red; a yellow line on subdorsal ridge, bent up at the large horns, the dorsal space filled in with dark purple except in a space from joint 7 posteriorly to joint 9 anteriorly. Sides green, the lateral horns colorless. Length, 3.2 to 4.7. mm.

Stage V.—Horns as in *Euclea delphinii*, the spiracle on joint 5 moved up. Long horns on joints 3 to 5 and 12 red tipped, the short ones pale yellow, lateral ones colorless. Colors as before, the waved

purple patches extending on joints 3 to 7 and 9 to 12, separated by a green space. Spines with black tips, rather delicate; skin closely and finely clear granular. Depressed spaces (1) and (2) indicated as glandular dots, large lateral ones (4) as ill defined hollows, all obscure. Head greenish, eye black. Length, 4 to 6.5 mm.

Stage VI.—As before; patches dark reddish purple. Subdorsal horns on joint 6 and 7 moved outward a little, not in line with the others; that on 8 rather larger than the other short horns. A distinct green line edges the subdorsal band below. Dorsal purple band broken as before or continuous, incised at the large horns. Sometimes the subdorsal horns of 11 and 13 are red tipped as well as 3 to 5 and 12. The purple band is bordered with crimson; a pale dorsal line; no caltropes. Length 5.7 to 9 mm.

Stage VII.—(Plate I, Figs. 9, 10 and 11) Appearance as before, but there are caltrope patches (Plate I, Fig. 14) on top of the lateral horns of joints 6 to 12 and a large one on joint 13. Dorsum purple, darker at the edges, incised by yellow on joints 4, 5, 8, 11 and 12; a straight pale dorsal line and the glandular dots (1) whitish, two pairs on incisures 3–4 and 4–5, one pair in the other incisures. Addorsals (2) indicated as tiny pale dots, seen on joints 9 and 10. Long horns on 3, 4, 5, 8, 11, 12 and 13 red, the rest yellow, the largest .6 to .7 mm. long, the shortest rounded. Sides green, darker below both ridges, a broken whitish line along lateral ridge. Depressed spaces (4) show faintly and an ill defined hollow between the segments subventrally (7). Skin with low conic clear granules (Plate I, Fig. 12); spines small, black tipped (Plate I, Fig. 13). Length 8.2 to 11.8 mm.

Besides this, the usual form, examples occur with more red, or with less.

Form A.—Normal; no red except the subdorsals of 3 to 5, 8, 11 and 12, and the lateral of 3. Sides green, a broken yellow line on lateral ridge.

Form B.—Subdorsal horns 3 to 13 and lateral 3 all red; some yellow shading in the lateral space, the lateral line nearly continuous.

Form C.—Horns red and a vermilion stripe connecting their bases on joints 3 to 12; purple marks with a crimson edge and a blurred, irregular, crimson band in the lateral space, shading into the subdorsal red anteriorly; below it a yellowish or whitish shading.

Form D.—Subdorsal horns on 3 reddish, all the rest yellow; dorsal purple band pale, edged with green inside the yellow line, divided by yellow on joints 8, 11 and 12.

Food-plants observed.—Willow, oak, wild cherry, bayberry, linden, witch-hazel, chestnut, beech and sour-gum (*Nyssa*).

EXPLANATION OF PLATE I.

Tortricidia fasciola.

Fig. 1. Larva in stage I, side view, enlarged.
" 2. Larva in stage VI, side view, enlarged.
" 3. The same, front view.
" 4. One segment, stage VI, showing setæ.
" 5. Skin granules at one of the setæ of lateral row.
" 6. Mature larva, enlarged, dorsal view.
" 7. Moth of *T. fasciola.*

Adoneta spinuloides.

" 8. Larva in stage I, side view, enlarged.
" 9. Mature larva, side view, enlarged.
" 10. The same, front view.
" 11. The same, back view.
" 12. One of the short horns of subdorsal row and adjacent skin granules.
" 13. A single spine, enlarged.
" 14. Caltropes from a lateral horn.
" 15. Moth of *A. spinuloides.*

Euclea indetermina *Boisduval.*

1864—*Callochlora vernata* Packard, Proc. Ent. Soc. Phil. III, 339.
1882—*Parasa chloris* Grote, Check List, 17.
1891—*Parasa viridus* Dyar, Trans. Am. Ent. Soc. XVIII, 154.
1891—*Parasa viridus* Smith, List Lep. 28.
1893—*Euclea indetermina* Dyar & Doll, Ent. News, IV, 311.
1894—*Euclea indetermina* Neumoegen & Dyar, Journ. N. Y. Ent. Soc. II, 68.

LARVA.

1797—Smith & Abbot, Lep. Ins. Ga., pl. 73.
1832—Boisduval, Cuvier's An. Kingd. (Griffith), Pl. 103, Fig. 8.
1852—Harris, Ins. Inj. Veg. 323.
1858—Duncan, Nat. Libr. XX, Pl. 21.
1878—Andrews, Psyche, II, 271 (as *Parasa chloris*).
1885—Edwards & Elliot, Papilio, III, 128.
1885—French, Can. Ent. XVII, 161.
1893—Dyar & Doll, Ent. News, IV, 311.
1894—Dyar, An. N. Y. Acad. Sci, VIII, 214.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space broad, narrowing only slightly at the ends, curving down anteriorly and posteriorly at joints 3–5 and 11–13. Sides nearly

perpendicular, the lateral and subventral areas practically continuous, the latter not retracted, spiracles exposed. Elongate, subcylindrical, the subdorsal ridge marking the change in direction of back and sides; lateral ridge slight. Horns well developed, irregular, well armed with strongly stinging spines. Subdorsals on joints 3 to 5, 8, 11 and 12 long, those on 5, 8, 11 and 12 longest, 6, 7, 9 and 10 very short; lateral horns moderate, those on joints 3 and 4 longest, that on 5 absent. Depressed spaces feebly developed, (1) to (4) (7) and (8) indicated by obscure dark, impressed dots, (1) paired. Skin densely finely spinulose-granular, the granules colorless. Patches of caltropes are present on the lateral horns of joints 6 to 13 and subdorsal horn of 13, but no detachable spines. The larva is very brightly colored. In the first stage the horns have the structure and arrangement of *E. delphinii*, three setæ from the apex of each.

This larva stands near *Sibine stimulea* in degrees of specialization. Its skin structure is higher, but the detachable spines are absent and the coloration is less diversified. It is, therefore, on the whole, a little lower than Sibine. It stands, perhaps, nearest the main stem of the spined Eucleids of any of our species. The horns at maturity are scarcely modified in relative proportions from the condition in stage I; the primitive bright warning colors are present and the urticating spines are in full functional activity, neither as yet affected by degeneration. The shape is more like that of an ordinary lepidopterous larva than usual. Therefore, we may regard *E. indetermina* as, on the whole, most like the ancestor of the spined Eucleids of any New York species, exclusive of *Phobetron pithecium*, which represents a still older condition.

AFFINITIES, HABITS, ETC.

This species is a typical representative of the group of spined Eucleids. Its near allies are found throughout South America and in India. Our nearest species is *Euclea delphinii*. The moth, however, so closely resembles that of *Parasa chloris* that the two species were for a long time confounded. They were separated by Grote in 1881, but Herrich-Schaeffer's figure was not correctly identified. It was suggested by Andrews, from the structure of the larva, that the species should be placed in *Euclea* rather than in *Parasa*, and this opinion is confirmed by the venation of the moth.

E. indetermina has a southern range. It occurs around New York City, but seems to be entirely absent from the Hudson valley. It is rather local in its appearance, often being common in certain localities

and absent in others near by. Though not gregarious many are often found on the same bush. They are low feeders, not occurring on trees to any extent.

The eggs are laid during July and the larvæ mature toward the middle of September. They remain on the under sides of the leaves in spite of their very conspicuous coloration. The effect of a touch of their spines is about the same as that of *Sibine stimulea*. The larvæ have eight stages, occasionally nine. Two examples bred from eggs of the same moth varied in this respect. They do not feed in stage I, which is rapidly passed through.

I am indebted to Miss Morton for obtaining for me the eggs from moths bred from larvæ part of which I collected and part obtained from Mr. Doll.

CRITICISM OF PREVIOUS DESCRIPTIONS.

All of the references given are to figures or descriptions of the mature larva, none of them going into structural details. The two best are that of Professor French (1885) and my own (1894). I notice nothing important of a positive nature to criticize except that in Prof. French's account the segments from which the horns are said to arise are not quite accurately numbered.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Singly, or in small groups, slightly imbricated. Elliptical, flattened, translucent pale ocher yellow on glass, 1.5 x .9 mm.; reticulations obscure, visible only in a strong light, rounded hexagonal, nearly linear, somewhat irregular. No special characters. They hatch in nine days.

Stage I.—(Plate II, Fig. 1.) Not different in structure from *Euclea delphinii*, the horns proportioned the same, each with three setæ with slightly swollen tips. Color rather dark yellow, shining, the long horns whitish. Segments well marked; skin smooth. Shape as usual, elongate, squarish, the horns low conical, prominent, their bases contiguous. Length 1.1 mm. The larvæ do not feed in this stage.

Stage II.—Subdorsal horns on joints 3, 4, 5, 8, 11 and 12 large, rounded; the rest small, all furnished with stinging spines; the short subdorsals (joints 6, 7, 9, 10) bear only one spine and are crowded up adjacent to the next large horn. Spines pale, black tipped. Ridges whitish, but dorsal and lateral spaces faintly shaded with dull red; horns pale. Dorsal depressed spaces (1) cleft-like with paired dots. In shape the larva is thickest through joints 4–5, the outline elliptical;

dorsum flat, sides nearly perpendicular, composed of both lateral and subventral spaces. During the stage the color changes. Dark brown, the subdorsal horns pale yellow, only the long ones visible. Subventral space very narrow, the bulging subventral edge colorless. Length 1.1 to 1.8 mm.

Stage III.—Upper side dark velvety brownish red as far as the upper edge of the lateral horns; subdorsal horns on joints 3, 4, 5, 8, 11 and 12 large, thick, light yellow, the short horns not showing; lateral horns all small and with the subventral space light yellow. Skin obscurely finely granular. Dorsal pale dots paired, very faint. The short subdorsal horns have one spine only. Length 1.8 to 3 mm.

Stage IV.—(Plate II, Fig. 2.) As before. Color velvety red-brown, the long horns and subventral region pale yellow; a white line along subventral edge. Later the long horns become orange at the tips and a straight white line appears along the middle of the sides between the subdorsal and lateral horns, broken segmentally. Body high, sides nearly perpendicular, horns erect. The short subdorsals have two or three spines and are situated as before adjacent to the long ones. Length 3 to 4 5 mm.

Stage V.—The six pairs of long horns prominent, thick, alike and well spined; bright red; the four short ones small, rounded, inconspicuous, yet reddish. A faint pinkish dorsal line and traces of one along the subdorsal ridge, ill defined on the dark purple ground which reaches to the lateral horns. Lateral horns faintly pinkish. Subventral region colorless, white on the lower edge. Later in the stage all the horns are fine red and three pale lines can be seen, an addorsal pair besides the dorsal, these new lines faint and broken by the large horns. Also three pale lines in the lateral space, one above and one below the original lateral line. Length 4.5 to 7 mm.

Stage VI.—Horns short at first and pale, but they quickly grow. Color all purple brown, the horns red. Dorsum with three bluish white lines, the outer ones waved and indistinct, lateral space with three yellowish white lines, only the middle one distinct; subventral space with two white lines; obscure red lines along the two rows of horns. Skin finely clear granular. Later the broad lateral pale line and subventral edge may be tinged with red. Length 7 to 10.5 mm.

Stage VII.—The purplish black ground is now so much narrowed that it appears rather as dark lines on a pale ground. Dorsal space contracted at joints 3, 4, 5, 8, 11 and 12, traversed by three bluish white and four purple lines, somewhat broken. Subdorsal ridge whitish

above, broadly red centrally, the horns bright red. Sides blackish purple, a broad lateral line and the subventral edge red; a narrow whitish line above and below the lateral red line, the upper broken. A broad pale stigmatal line. Lateral horns red. Spines pale with black tips; skin clear granular. Small patches of caltropes are present on the tips of the lateral horns on joints 6 to 12 in eight stage larvæ. Length, 10.5 to 16 mm.

Stage VIII.—(Plate II, Fig. 3) Shape as described. The blackish lines are now still narrower and appear plainly as lines. Dorsal space bluish white with four black lines, waved and confluent opposite the large horns. The rest of the ground color pale yellow, the horns fiery red. Red bands along subdorsal and lateral ridges, in the middle of lateral space and along subventral edge. Sides with four black lines, subconfluent in pairs; subventral area with two black lines. Joint 2 purplish; venter honey brown. The red side-band is partly cut by the pale, dark centered, depressed spaces (4); spaces (1) small, paired, dark. Skin clear granular (Plate II, Figs. 4 and 6). Caltrope patches (Plate II, Fig. 10) present on the lateral horns of joints 6 to 12 and the subdorsal of joint 13. Spines enlarged at base, pale with black tips (Plate II, Fig. 8). Length, 16 to 22 mm.

In the yellow form all the red markings are bright yellow. It did not come under observation in the early stages, but doubtless differs from this only in the absence of red, beginning with stage IV. The yellow form seems the more generalized of the two.

Food-plants.—The larvæ feed on various kinds of low brush. I have notes of finding them on wild cherry, oak, hickory and bayberry.

EXPLANATION OF PLATE II.

Fig. 1. Larva in stage I, side view, enlarged.
" 2. Larva end of stage IV, dorsal view, enlarged.
" 3. Full grown larva, enlarged.
" 4. Skin granules from the region of the subventral ridge × 50, showing setæ iii and iv.
" 5. Base of same seta × 175.
" 6. Skin granules from region of subdorsal ridge × 175.
" 7. Abnormal skin granules from region of joint 2 × 175.
" 8. End of one of the large horns × 50, showing the wrinkled skin and spines.
" 9. Tip of a stinging spine × 175.
" 10. Caltropes in position × 175.
" 11. Moth of *Euclea indetermina*.

THE IMMATURE STAGES OF DIABROTICA SOROR.

BY R. W. DOANE.

[Mr. R. W. Doane, a student of entomology in this University (Stanford), undertook during the college year 1895–96 the study of the life-history of *Diabrotica soror*, the Pacific Coast representative of the destructive Diabroticas. Despite the abundance of *soror*, its serious ravages on flowers and fruits, and a lively interest on the part of entomologists in its habits, its life history has remained unknown. By reason of Mr. Doane's removal, his work, well begun and successfully prosecuted as far as carried, has been interupted. The following descriptions of the egg, larva and pupa, together with a few notes on the habits of the species, are extracted from his notes.—VERNON L. KELLOGG, Stanford University, California.]

The following descriptions were made from a number of specimens taken in the field and laboratory.

Egg.—Length, .7 mm.; width, 5 mm.; oval, dirty white in color; surface finely sculptured by minute hexagonal pitted areas. These areas under a higher power lens show several irregular depressions within their own surface.

Full-grown larva.—Length, 12 mm.; width, 1.3 mm.; body cylindrical, slightly tapering toward the head; the twelve segments behind the head indistinctly separated. General color, except the head, dorsal shield and last abdominal segment, dirty white, often becoming more yellowish before pupation. Head dark brown above and on the sides, same color as rest of body below; posterior margin with a deep, quite broad, V-shaped incision, ending in a broad deep suture which runs cephalad for nearly one-third the length of the head, then divides into two well-marked sutures which extend to the base of the antennae. These sutures divide the head into three distinct parts, the anterior part being the largest, the other two parts are equal and constitute the posterior and part of the lateral portions of the head. There is a dark median line ending at the tip of a small V-shaped incision in the anterior margin of the head, and a few rather strong hairs scattered over the surface of the head. Antennæ white, three-jointed; first joint a little broader than its length, second joint the shortest, narrower than the first, third joint cone-shaped, its greatest width about equal to its length. No eyes. Labrum same color as rest of the head. Mandibles dark brown, darker at tips, other mouth parts and appendages whitish.

Cervical shield brown, paler than the head, broadly shield-shaped with quite a broad median white line, a few rather long hairs and several shorter ones scattered over the surface. The remainder of the prothorax, the meso- and meta-thorax same color as the rest of the body. Legs pale, three-jointed, supported by dark brown chitinous framework; several short rather stout hairs on each segment; a whitish, elliptical, striated lobe arising beside the single brown tarsal claw. Segments four to eleven, all similar, skin wrinkled, somewhat papillose, a few scattering hairs over each segment; on the lateral margin of each segment is a long stiff hair just posterior to one and sometimes two smaller and shorter hairs. Dorsal shield of posterior segment semicircular in outline, dark brown, finely sculptured so as to produce numerous hexagonal pitted areas much resembling the markings on the eggs; several strong marginal hairs and two sub-triangular processes near the posterior end. A single fleshy proleg.

The larva agrees almost perfectly with Prof. H. Garman's description of the larva of *D. 12-punctata* as given in Psyche, Vol. VI, p. 48. The only special difference I would note is in the description of the dorsal shield of the posterior segment which he describes as follows: "Dorsal shield of posterior body segment nearly circular in outline, brown, with numerous minute black specks, slightly rimmed at posterior margin, and in young examples obscurely bituberculate; furnished with several strong marginal hairs, and with four minute, striate, centrally-placed spatulate appendages."

Pupa.—Whitish or straw-colored. Length .4 mm., width .2 mm. Scattered brown hairs over the body arranged as follows: six on the head arranged in three transverse pairs, one pair close to the base and just cephalad of the antennæ, one just caudad of the antennæ, and one near the meso-dorsal angle of the eyes; ten on the prothorax, one pair on the anterior margin, one pair near the lateral margin, and one pair near the posterior margin, a pair just anterior and a larger pair just posterior to the middle near the mesal line; an arched row of four hairs each on the meso- and meta-thorax; a pair in the middle and one on each side of each abdominal segment; last three segments with another pair slightly anterior to and more widely separated than the median pair; last segment also with a pair between and a pair in the bases of the caudal spines, and another pair just anterior to the lateral pair. Caudal spines usually slightly curved, brownish at tips. Each femur with three hairs near the extremity. Wing pads clear white, covering the proximal part of the posterior femor. Antennæ curving outward

around the femora of the meso- and meta-thoracic legs, then meeting on the median ventral line between them.

As the pupa grows older the eyes, wing parts, parts of the legs and antennæ and the tips of the mandibles begin to turn much darker.

Soror is especially injurious to the interests of the flower-grower. The beetles eat unsightly holes in the buds and petals of roses and chrysanthemums, and other showy flowers. It feeds on leaves too, and is almost unrestricted in range of food-plants. Fruit-growers often suffer serious loss by the beetle's eating the young forming fruit. The apricot seems especially the object of attack. Hardly any kind of garden vegetable is free from its attention.

The eggs are deposited, in breeding jars or out of doors, from ¼ to ½ an inch below the surface of the ground, near the base of some plant, sometimes singly but usually in numbers of from 20 to 50. The eggs hatched in the breeding jars in about eighteen days. The larvæ developed slowly. Larvæ of various sizes, some full grown, some newly hatched, were found around the roots of different plants out of doors in March, April and May. The larvæ do not bore into the roots, as *longicornis* and *12-punctata* do, but eat the roots from the outside, sometimes cutting the young rootlets entirely in two. The larvæ were found in abundance feeding on the roots of sweet-peas and alfalfa, and sparingly on other plants.

As the larva becomes full-grown it approaches the surface of the ground and forms an oval or spherical cell in which it lies ten or twelve days, semi-quiescent, before pupation. The pupal stage lasts from ten to fourteen days. The first out-of-doors pupæ were found early in April.

No special opportunity of combatting the pest is offered by its immature stages. The wide range of food-plants of larva and adult, and the underground life of the immature stages, make it a particularly difficult insect to fight.

NOTE ON CATOCALA ELDA *Behr.*

BY WM. BEUTENMULLER.

This insect was described as a distinct species from a specimen taken in Oregon. Since then three examples have been taken in British Columbia, and last summer Mr. Doll raised a single specimen from a larva found on Long Island, N. Y. It is, without doubt, nothing more than a gray variety of *C. relicta.* Mr. Palm already called attention to this fact. (Journ. N. Y. Ent. Soc., I, p. 21.)

ON THE LARVÆ OF CERTAIN SAW-FLIES (TENTHREDINIDÆ.)

BY HARRISON G. DYAR, PH. D.

Trichiosoma crassum *Kirby.*

Mr. MacGillivray has sorted out my bred material into two species of *Trichiosoma, T. triangulum* and *T. crassum.* There was no corresponding difference in the larvæ, however, and, therefore, that of *T. crassum* may be described as being indistinguishable from that of *T. triangulum.* (See Ent. News, vi, 199.)

Food-plants.—Willow, poplar, wild cherry and alder.

Hylotoma scapularis *Klug.*

The flies mentioned in Can. Ent., xxvii, 344, under label 2B were pronounced by Mr. MacGillivray to be males of this species. The following is the present state of this confusing subject:

Larvæ head black or red.
 No paler subdorsal line.
  Tubercles distinctly black.
   Head red, body yellow; on birch .... V.
   Head black, rarely reddish, body yellow; on wild cherry .... S.
  Tubercles blackish only, or pale in black rings.
   Head blue black, body yellow; on oak 2B
 A pale yellow subdorsal line.
  Head red or black, body greenish-yellow; on willow 2C
Head pale testaceous with vertical dark band.
 Body green, tubercles nearly all pale 2L

Here are five rather distinct types of larvæ. From V have been bred *H. pectoralis, H. scapularis* ♀ and *H. cæruleus* ♂; from S has been bred *H. mcleayi*; from 2B *H. scapularis* ♂; larvæ 2C were bred from eggs laid by a female *H. clavicornis;* 2L produces *H. mcleayi* ♂ and *H. virescens* (*clavicornis*) ♀.

Description of larvæ 2B. Four last stages observed with widths of head .8, 1.1, 1.8 and 2.5 mm. Head rounded, uniform blue-black, the sutures scarcely visible; small black setæ in front. Body cylindrical, subventral ridge prominent; thoracic feet large, pale yellowish brown, the large basal joint blue-black. Abdominal feet on joints 6 to 10 and 13 small, the last pair rudimentary, pale at tip, their bases dotted with black. Segments coarsely 3-annulated with nine large (.35 mm.) setiferous tubercles in an approximate square, the lower posterior one moved inward; another behind the spiracle; these tubercles are black-

ish or yellow, edged with black. Subventral ridges oblique, prominent, pale, but margined with black and bearing many setæ. Anal plate obscure, blackish. Between the setæ are numerous small black dots bearing still more minute setæ. A row of four ventral setiferous black spots on each segment anterior to the legs and six medio-ventral segmentary round orange spots posterior to the feet on joints 6 to 10. Forms a reticular cocoon of yellow silk.

Macrophya bilineata *MacGillivray.*

Head whitish, eye black, a large black patch on vertex, neat, almost pyriform. Body segments 7-annulated with minute black setæ on the second and fourth annulets. Body tapering a little posteriorly, straight or curled spirally, feet on joints 6 to 13. Whitish, translucent, not shining, appearing green from the food except subventrally; a faint black lateral shade bounding the apparently green area; a single small sooty black suranal spot. Tracheæ distinct; thoracic feet clear with brown tips. Width of head 1.8 mm.

Ultimate stage.—Annulate, slightly shining, all immaculate, waxy, whitish emerald green. Head slightly testaceous, eye black, no marks. Enters the ground.

Food-plants.—*Viburnum opulus* and *V. cassinoides.*

Macrophya mixta *MacGillivray.*

Head reddish on vertex, eye black, no marks; width 1.8 mm. Body waxy greenish, 7-annulate, no marks. Another example had a dusky lateral shade defining the dorsal color which appears darker than the subventral region on account of the food showing by transparency. Ultimate stage like the preceding species.

Food-plant.—*Viburnum opulus.*

These two species of *Macrophya* occurred together and only one example of each was bred. I suspect that they are not specifically distinct.

Tenthredo remota *MacGillivray.*

Resembles *T. cressoni,* but less yellowish green, the skin being colorless and only green from the food; no subdorsal band of fat, at most only a few scattered granules. Widths of head observed .6, .8, 1.4, 1.8, 2.2 mm.

The egg forms a regular elliptical swelling near the middle of a leaf, 2 x 1.5 mm., under the lower epidermis, the saw-cut on the upper side.

Larva.—Head large, prominent, with grooves before the vertices

of the lobes; pale below, orange above, shining, eye black, no marks. Joint 2 small, the body only slightly tapering; feet on joints 6 to 13. Whitish translucent, not shining, food green the whole length, plainly visible. Thorax scarcely enlarged; segments finely and neatly 7-annulate, the incisures more distinct, slightly folded. Under a lens white points are present on the second and fourth annulets. No marks; thoracic feet colorless. Tracheal line not very distinct.

Ultimate stage.—Head shining whitish testaceous, eye black; body shining, pale clear honey yellow, rather whitish, somewhat opaque, neatly annulate; no marks.

Food-plant.—Yellow birch.

Taxonus dubitatus *Norton.*

Stage before last.—Head pale yellowish, a trace of brownish from minute dottings; a very small brown dot in apex of clypeus and behind eye, eye in a black spot. Body sordid waxy, green from food, anal end dark; segments 7-annulate, first and second annulets largest. No marks except the small black spiracles, antennæ, palpi, jaws and claws of thoracic feet.

Last stage.—Head pale brownish, a big black patch behind the eye. Body without marks except a large black subdorsal patch on joint 13 anterior to the anal flap; green from food, faintly yellowish, paler subventrally. Others have more spots on the head.

Foad-plant.—*Onoclea*, sp. Occurred around New York City.

Taxonus albidopictus *Norton.*

Head shining pale brownish, a large triangular black patch on the vertex connects with a like one on the clypeus; another patch at its apex on the black eye reaching back to the occiput; these three patches have diffuse edges and the vertical and lateral ones are connected by a dark cloud; mouth brown; width 1.2 mm. Feet on joints 6 to 13; segments 7-annulate, rather unequal, annulet 2 large; slightly shining, smooth; dorsum to spiracles dark green, under the lens obscurely longitudinally streaked and divided by the pale dorsal vessel, especially on the thorax; on joint 13 a large round smoky black lateral patch; joint 2 anteriorly, subventral region and feet translucent whitish, thoracic feet black marked; spiracles black, tracheal line white. Bored in wood. Found on *Onoclea sensibilis* at Rouse's Point, N. Y.

Mr. MacGillivray remarks "this differs from the description (of Norton) in having more of black on the base of the abdomen and in having the apex of the posterior femora whitish. Judging from Pro-

vancher's description it is undoubtedly *albidopictus*." The larvæ of these two species of *Taxonus* cannot be certainly distinguished.

Harpiphorus tarsatus *Say*.

Eggs.—Laid under the lower epidermis, sawed through from above; close to the midrib in a long line, the cuts united; one edge of the swelling is on the midrib or large vein, the other parallel to it but wavy, composed of the numerous saw cuts; width 1 mm.; length 4 to 30 mm., according to the number of eggs laid; punctures .8 mm. apart.

Stage I.—Nearly colorless, head with a smoky tint especially in a shade upward from the black eye; width .5 mm.

Stage II.—Head brownish, a shade upward from the black eye; width .6 mm. Body all subtranslucent white, no marks; food green in thorax, more yellowish posteriorly; segments finely annulate. Body shape much as in the mature form; length 4.5 mm.

Stage III.—Head dark blackish brown, eye black; width .8 mm. Body without marks.

Stage IV.—Head brownish, a darker shade on the outer sides of the lobes; width 1.0 mm. Body whitish, the food green, anal plate brownish, feet colorless.

Stage V.—Head shining black; width 1.2 mm. Joint 2 anteriorly, subventral region and feet pale yellow; dorsum sordid pale olivaceous without marks, slightly shining; annulations obscure; anal plate dark. Length 12 mm.

Stage VI.—Head shining black; width 1.6 mm. Joint 2 and subventral region pale yellow; dorsum with a blackish rectangle on each segment on a whitish ground, the rest of the dorsum colored nearly like the sides. Later the coloration is more like the next stage.

Stage VII.—Like the next stage, but the marks a little fainter; with of head 2 mm.

Stage VIII.—Head small in proportion, lower than joint 2, all black, slightly shining, width 2.5 mm. Joint 2 anteriorly, subventral region, venter and feet orange yellow; dorsum to spiracles olivaceous black, annulet 2 in the middle and whole of annulet 4 to the subventral color pale greenish gray, both interrupted by the olivaceous dorsal vessel. Segments 6-annulate, the second and fourth with minute setæ. Anal plate black, darker than the dorsal marks. Thoracic feet spreading, pale yellow, not very large; abdominal feet all well developed. Body large at joint 2, gradually tapering posteriorly, rapidly at the end of joint 13. Length about 25 mm., width 4 mm. The pale dorsal bands

contain fat granules. In some examples they are broad and the dark markings diffuse and pale. No bloom or white down.

Stage IX.—(Ultimate.) Exactly as in the last stage except that the dorsal pale annulets are light blue instead of greenish gray, the black is bluish rather than olivaceous and the skin is very slightly more shiny. Head 2.5 mm. The larvæ bore in wood to pupate.

Food-plant—Dogwood (*Cornus alternifolia*).

Harpiphorus varianus *Norton.*

Described by me (Can. Ent., xxvii, 196) as *H. tarsatus*. The flies of these two species are occasionally alike in color, as Mr. Harrington indicates, but Mr. MacGillivray has separated them by the structure of the female saw-guide and saw. The larvæ are abundantly distinct.

Harpiphorus versicolor *Norton.*

Eggs.—About three laid side by side under the lower epidermis from above; a short row nearly parallel to a side vein; 1.5 $\times$ .6 mm., swelling the leaf; faintly yellowish with a green central area.

Stage I.—Head pale brown, eye black; width .33 mm. Body curled, whitish, rather opaque, without bloom. Food green in the slightly enlarged thorax.

Stage II.—Head pale brownish, darker over the vertex; width .5 mm. Body annulate, colorless or greenish from food, mealy white.

Stage III.—Head black, mealy only in a band across between the eyes; width .8 mm. Body yellow, well covered with the white mealy secretion.

Stage IV.—The same. Width of head 1.1 mm.

Stage V.—Width of head 1.5 mm.

Stage VI.—Head black, slightly mealy except the eye and mouth; width 2.1 mm. Body coarsely 6-annulate, mealy or short woolly to and including the subventral folds; no marks whatever; feet on joints 6 to 13. Thorax slightly enlarged.

Differs at once from *H. varianus*, in being without the black anal plate.

Stage VII.—(Ultimate.) Head black, yellow below the eyes, no bloom; width 1.5 or 2.1 mm. Body shining, the subventral folds and venter ocher yellow, dorsum blue gray, marked with leaden black on annulets 1, 3, 5 and 6 subdorsally and on all the annulets laterally, leaving a dorsal and a subdorsal line of the ground color connected on annulets 2 and 4. The lower end of this dorsal color is incised before the spiracle by the upper yellow subventral fold. Feet all pale; bores in wood. Found on *Cornus* at Greenwood Lake, N. J.

The following species have been named by Mr. C. L. Marlatt:

Schizocerus prunivorus *Marlatt.*

Egg.—In a pyriform slit under the lower epidermis at the middle of one edge of the leaf; laid singly. The larva hatches and eats a curious winding slit down into the leaf; later this reaches the edge.

Stage I.—Head pale greenish testaceous, eye black; width .4 mm. Body segments well marked, the incisures more perpendicular in front than behind, faintly 3-annulate. Translucent with a greenish tint; alimentary canal visible. Thoracic feet large, colorless with black shades at their bases; abdominal ones very small on joints, 6 to 11 and 13, colorless; joint 13 slightly bulging, with very small anal prongs.

Stage II.—The same; head green, width .6 mm.

Stage III.—Head .75 mm. All leaf green, blackish shades at the bases of the abdominal feet, eye black, mouth brown. Large suranal prongs green and a smaller more approximate subanal pair. Joint 13 a little enlarged. On joints 5 to 13 a series of small, colorless, eversible lateral glands. Abdominal feet rudimentary.

Stage IV.—Head 1.15 mm. All leaf green, a little brownish at the vertex, eye black. Body leaf green, shining, 3-annulate, food darker. Thoracic feet clear with a blackish cloud at base; abdominal ones rudimentary. Six anal prongs; a small pair at end of plate, a large lateral pair, reddish tinted and the small subanal pair. Lateral glands situated substigmatally, posterior. Subventral ridge distinct; tracheal line fine.

Stage V.—Head pale green, thickly brown dotted, eye black; width 1.4 mm. Body green, faintly 3-annulate, slightly blotched with yellowish subventrally; a black subventral shade on the thorax in spots at the bases of the feet which are green, clearer at tip. Subventral ridge fluted, glands small; the four suranal prongs brownish, subanal pair green. Tracheal line distinct; spiracles dark; no marks. Cocoon in the ground, reticular, of yellow silk.

Found on *Prunus pennsylvanica* and *Amelanchier canadensis* at Jefferson Highlands, N. H., and on *Prunus serotina* at Bellport, Long Island, N. Y.

Camponiscus americana *Marlatt.*

Head pale brown, shining, eye black; width 1.5 mm. Thorax enlarged, the feet spreading, pale; abdominal ones on joints 6 to 11 and 13. Segments indistinctly annulate, incisures well marked, folded. Whitish, not shining, the food makes the dorsum to spiracles green, the

posterior end of alimentary canal forms a blackish shade which looks like a mark at first glance. Thorax higher than head. Sits flat on the venter, usually curled spirally when at rest. Five stages were observed, but not consecutively.

Found on the poplar at Plattsburgh, N. Y., and at Jefferson Highlands, N. H.

Pontania populi *Marlatt.*

This is evidently what Mr. Marlatt had in mind when he said of the habits of the larvæ of *Pontania*, "at least one America species develops in the rolled or folded edge of the leaf."* The present species forms at first a small gall, but soon the leaf rolls over, gall and all, forming two or three turns and the larva lives in the tube so formed, without spinning any sort of web.

There are probably five larval stages. The larva remains in the gall up to as late as the fourth stage, but is usually out to feed in the third. It may be in the rolled part permanently in stage IV.

Gall.—A low irregular swelling on the upper side of the leaf, the nearest veins enlarged and tending to curve backward, rolling the leaf with the back side inward. Under side of gall thin, flat or irregularly rugose; above scarcely much thickened but folded up. Green or yellowish, an ill-defined swelling about 5 mm. in diameter, concealed in the rolled leaf.

Stage II.—(In gall.) Head pale brown, paler over the clypeus; body shining whitish; width of head .36 mm.

Stage III.—Head pale brown above clypeus; width .55 mm. Body annulate, shining, no marks; anal prongs dark.

Stage IV.—Head very pale brown; width .7 mm. Body colorless.

Stage V.—(In leaf.) Head all pale brown; width 1.0 mm. Body segments 3-annulate, whitish, scarcely shining, food green; two dusky brown corneous patches precede the dark tipped anal prongs.

The larvæ never eat the whole leaf, but the parenchyma only, even in the last stage. They spin small brown cocoons.

Found on *Populus grandidentata* at Fort Lee, N. J. There is more than one brood in the season, the larvæ infesting the successive leaves of young shoots.

Pontania terminalis *Marlatt.*

Allied to the preceding. Egg deposited under the lower epidermis forming a small gall-like swelling of the type of *P. populi*, but less pro-

* U. S. Dept. Agriculture, technical series, No. 3, 1896, p. 8.

nounced. A green elevation of the upper surface; below a thin skin, not swollen, but slightly yellowish; the leaf rolls over tightly in a close coil to two whole turns, finally as far as the midrib, from one half to the whole of one side of the leaf being involved. The little larva lives in the gall, but soon comes out of it and rests in the rolled part.

Stage II.—Head pale brownish, the eye black; width .3 mm. Body all whitish, food forming a narrow green line; slightly shining, annulated, thoracic feet of good size.

Stage III.—Head and anal flap shining black; width .4 mm. Body whitish, slightly shining, annulate.

Stage IV.—Head shining black; width .55 mm. Body shining, no distinct setæ, irregularly 4- to 5-annulate; feet on joints 6 to 11 and 13. Body whitish, slightly opaque, food green; the whole of anal flap black; anal prongs short, black.

Stage V.—Head pale in the sutures, a large black patch on each lobe and one in the clypeus; width .8 mm. Body 3-annulate, smooth, not shining, whitish with a slight yellow-green tint, food green; anal end concolorous, no patch at all, though the frass gives a dusky shade. Prongs very short, brown tipped. The larvæ eat the parenchyma only, as in the preceding species.

Found on willow at Van Cortlandt Park, New York City.

Pteronus dyari *Marlatt.*

I supposed this species to have been bred from the same larvæ which produced *Amauronematus luteotergum* (Trans. Am. Ent. Soc., xxii, 304), but Mr. Marlatt finds the flies distinct. Further observations are needed.

Pteronus hyalinus *Marlatt.*

I have described the larvæ as *Nematus lateralis* (Trans. Am. Ent. Soc., xxii, 307).

Pteronus lombardæ *Marlatt.*

Larvæ indistinguishable from those of *P. ventralis*, feeding on poplar instead of willow (Trans. Am. Ent. Soc., xxii, 305).

Pteronus populi *Marlatt.*

Indistinguishable from *P. hudsonii* Dyar in coloration in the last stage.

Egg.—In a cluster of saw cuts close together, but irregular, under the lower epidermis at the apex of a leaf.

Stage I.—Head .6 mm. Larvæ all blackish. Gregarious, eating holes in the leaf.

Stage II.—Head, calculated, .75 mm. All blackish.

Stage III.—Head 1.2 mm., shining black. Body black, immaculate at first; later, in some, faint yellow lateral spots as in *P. ventralis.*

Stage IV.—Head black, width 1.6 mm. Body greenish, tubercles and streaks on the annulets slaty black, not entirely confluent, leaving some of the green ground color especially dorsally and laterally; orange spots distinct; feet colorless.

The males spin at the end of this stage, or at least with this coloration and width of head.

Stage V.—Head 2.2 mm. Coloration as described for *P. hudsonii* (see Trans. Am. Ent. Soc., xxii, 306). Anal prongs short, black tipped.

Found on *Populus grandidentata* at Jefferson Highlands, N. H. Apparently the same larva also on willow at Greenwood Lake, N. J., and received from Mrs. Slosson from Franconia, N. H. There is more than one brood in the year.

Pteronus ostryæ *Marlatt.*

Head 1.6 mm, pale testaceous, a black patch at the vertex, eye black. Body all green, tar brown on the folds, annulate, not shining, no marks, no setæ.

This larva fell to the ground while I was examining a hop hornbean tree. It was ready to spin and I have not observed it feeding or in the appropriate coloration.

Amauronematus oregonensis *Marlatt.*

Whitish green, pilose, solitary on woolly willow at Keene Valley, N. Y., and Jefferson Highlands, N. H. It has just the appearance of the back of the leaf.

Whitish green, a white addorsal and stigmatal line, produced by the edges of the dorsal vessel and the tracheal line, supplemented by a few white granules under the skin laterally. Segments 3-annulate, with concolorous warts on each annulet, bearing short white pile. Feet on joints 6 to 11 and 13. Thoracic feet colorless outwardly, greenish at base. Head same color as body, eye and mouth black; width 1.2 to 1.4 mm.

Ultimate Stage.—Head shaded with pale blackish, eye black; width as before. Body greenish paraffin color, shaded with black on the three annulets except for a central subdorsal space on each, in a narrow dorsal line and in stigmatal spots, and spots on the subventral folds. No setæ, the dark spots representing the warts. Feet colorless.

Both now and in the previous stage (except for the hairs) very like the following species.

This or the following larva is described by Dr. Packard in the 5th Report, U. S. Entomological Commission as "unknown saw fly larva" on page 589, number 72 of willow insects.

Amauronematus similis *Marlatt.*

Straight, solitary on woolly willow at Plattsburgh and Keene Valley, N. Y., and Jefferson Highlands, N. H.

Abdominal feet on joints 6 to 11, very slight on 13. Head whitish, a little mottled with green, not shining; width 1.4 mm., eye and mouth black. Body a little flattened, subventral region rather prominent, the posterior segments slightly tapering. Color soft leaf-green, not yellowish, not shining; a distinct white subdorsal line, the pair approaching and nearly touching on joint 13; the line sends down a mottled white streak on all the annulets as far as the tracheal line, sometimes separated, forming a lateral line of streaks. A few obscure white dots ventrally. The white bands and streaks are composed of white granules below the skin. Feet pale, thoracic ones clear. Segments not very distinctly 6-annulate, no tubercles; spiracles minute, brown.

The larvæ feed resting on the edge of the leaf. In some examples there are small black dots on the thorax and subventrally on the abdomen.

Ultimate Stage.—Slightly shining, light green, translucent like ground glass, uniform. Segments 6-annulate, the second and third larger than the others. Dorsal vessel a shade darker, its sides showing faintly whitish; tracheal line narrow, thread-like.

Later the larva is shaded with blackish on all the annulets and the top of the head; bores in soft or decayed wood to pupate.

Amauronematus dyari *Marlatt.*

Larvæ described by me (Can. Ent., xxvi, 187) as *Nematus monochroma;* later determined by Mr. Marlatt as *N. brunneus* (Can. Ent., xxvii, 342). The final decision makes it a new species.

Amauronematus azaliæ *Marlatt.*

Solitary edge-eaters on *Azalea;* found at Jefferson, N. H., in June. The larvæ all disappear before the end of June, and there is only one brood in the year.

Head a pale green, finely brown-dotted except a narrow space bordering the brown clypeus; eye black; width 1.2 mm. Segments irre-

gularly and faintly 5-annulate; shining green, the dorsal vessel dark, the tracheal line evident; no marks except little dusky rings subventrally defining the obsolate tubercles, which can also just be distinguished dorsally with a lens, though perfectly concolorous. Anal prongs very short, remote, obscurely black-tipped. Setæ very fine and short. Thoracic feet clear with brown claws.

The larvæ became streaked with dusky blackish on the annulets, bringing out the tubercles more distinctly and entered the ground to spin.

Hemichroa laricis *Marlatt.*

Head pale brown, dotted, eye black; a pale arcuate line over the clypeus: width 1.4 mm. Body segments 5-annulate, the last two annulets folded; feet on joints 6 to 11 and 13. Body green, shaded with opaque pale green pigment subdorsally and broadly stigmatally, leaving more translucent dorsal and lateral straight lines and small irregular areas among the subventral folds. The bright green fat granules composing the pigment are aggregated along the dorsal vessel, tracheal line and subventrally. Feet concolorous, the thoracic clear with brown claws. Tracheal line straight, white. The larvæ are solitary and rest on a needle of the food plant with the head toward the twig. They are very difficult to distinguish in this position, since the brown head harmonizes with the bark and the green-striped body with the leaves. Found on the larch at Jefferson Highlands, N. H.

This larva is described by Dr. Packard in Fifth Report United States Entomological Commission as "*Selandria* (?) sp.," on page 901, number 26 of larch insects.

Pachynematus affinis *Marlatt.*

Feet on joints 6 to 11, none on joint 13. Body segments 6-annulate, the last two annulets small and folded, whitish. Tubercles on the second and fourth annulets. Head pale greenish with a bright testaceous tint by transparency, eye black, jaws brown; width 1.8 mm. Body pale green with a distinct, straight, rather broad white stigmatal line on joints 5 to 12, lost posteriorly in a whitish shade which covers joints 12 and 13; the edges of the dorsal vessel form a distinct white geminate line on joints 3 to 11, pulsating, lost in the white tint posteriorly. A blackish green subdorsal band on thorax, also on the abdomen, but of varying distinctness. Tubercles small, concolorous and obscure, setæ rudimentary, dark, situated in two transverse rows, on the second and fourth annulets, and thickly on the subventral folds. Abdominal feet green; thoracic clear with brown tips.

Swept from grass at Jefferson, N. H.; also on grass by Mr. L. H. Joutel at Greenwood Lake, N. J.

Pachynematus pubescens *Marlatt.*

Head round, shining, testaceous, eye black; width 1.3 mm. Body pale pinkish brown, a broad addorsal and stigmatal white band. The former borders the dorsal vessel and the pair are separated by the dark blood; the latter is edged above by a blackish shade. All the lines run from joint 2, but are lost on joint 13, the frass showing as a dark shade. Body slightly shining; segments indistinctly 5-annulate; feet concolorous.

Found on *Carex* near the summit of Mt. Washington by Mrs. Zella Dyar.

Pachynematus gregarious *Marlatt.*

Eggs.—Laid in an irregular group of slits under the lower epidermis toward the center of a leaf. The slits are close together and after the larvæ emerge remain as irregularly placed, lunate, hollow ridges, elliptical when fresh; 1 x .5 mm.

Stage I.—Head blackish brown; width .35 mm. Body colorless.

Stage II.—Head pale with a black shade across the clypeus and on each side nearly to the vertex. Body shining, colorless; the lateral outline fluted, food green; sides of thorax bulging; tail often elevated. Thoracic feet dusky and the sides of the thorax dusky spotted.

Stage III.—Head .5 mm. Much as in the next stages, but the black parts brownish and shaded.

Stage IV.—Head .8 mm. As in the next stage, but the black more diffuse. The black marks on the body are small, but the elevations are present. Thorax enlarged, fluted.

Stage V.—Head 1.0 mm., rounded, tinted with pale testaceous, almost colorless except for a broad deep black band which runs transversely across the clypeus over the eyes and turns up posteriorly to the vertex, becoming smoky; mouth brown. Feet on joints 6 to 11, none on joint 12 and scarcely a trace on joint 13, yet the larvæ sit flat on the venter on the surface of the leaf. Thorax a little enlarged; abdomen slightly tapering, smallest posteriorly. Segments obscurely 4-annulate, the first annulet broad; pale, whitish, tinged with yellow, translucent, the alimentary canal showing green. On the abdomen on joints 5 to 11 a row of large round elevated black patches stigmatally and another above the bases of the feet, a little anterior to the middle of the segments. On joint 12 the spots are smaller, absent on joint 13. On thorax a small lateral spot and a large one above the base of each leg.

Body shining; tracheæ evident where not obscured by the large spots. Thoracic feet marked with brown; abdominal ones short, colorless. There are six colorless, eversible, ventral glands on joints 6 to 11.

Stage VI.—(Ultimate.) Head pale, the marks duskily clouded; a patch over eye and streak on vertex. Body whitish, the black marks supplemented by a series of black streaks on the annulets, diffusely spreading over the dorsum. The body is scarcely shiny and does not appear sticky. Width of head .8 or 1 mm.

Found on the willow at Jefferson, N. H., and Englewood, N. J.

These larvæ are gregarious, with all the appearances of slugs, though they are really not sticky as they look, but only very shiny. The number of feet and the ventral glands shows them to belong to the Nematinæ, although from general appearance one would suppose them to be some species of *Eriocampa* or *Monostegia.*

I was much surprised that the flies should belong to *Pachynematus.* The other larvæ of this genus are solitary grass feeders, whereas a larva very similar to this species is described as that of a species of *Pristiphora.**

TENACITY OF LIFE IN ADULTS OF CRYPTORHYNCHUS LAPATHI.

By F. M. Webster.

On August 24th, by invitation of Mr. Ottomar Reinecke, I visited the locality near Buffalo, N. Y., locally known as Beer Creek, where my friend had only a short time before discovered this species. We arrived on the ground about 3 p. m., leaving about 5 p. m., and during that time I was fortunate enough to capture eighteen specimens. These were placed in a small collecting bottle, heavily charged with cyanide of potassium, and had been prepared only a few days before. I had put in so much of the cyanide of potassium that it soon discolored the plaster parts in which it was embedded and collected so much moisture that my bottle was hardly fit for use. The specimens were placed in this bottle as collected, and remained therein until after 11:30 p. m., or from six to seven hours, when they were removed and placed in a small tight tin box. The following morning they were examined, but gave no signs of life. On returning home and opening the box, on August 29th, not only were nearly all alive, but several were found in copulation!

* *P. marlattiæ* Marlatt. "A smooth greenish slug with black head, feeding on black willow." Tech. ser. 3, U. S. Dept. Agr., p. 117.

THE CORRECT TITLE: NOROPSIS ELEGANS *Hübn.*

BY A. RADCLIFFE GROTE, A. M.

There are few species of moths, the Latin name of which has been given so variously as the very pretty insect which I venture to believe should be known in the future as *Noropsis elegans* Hübner sp. It is found commonly in the West Indies and in Mexico, but within the political boundaries of the United States is only hitherto reported from Texas, so far as I am aware. Not improbably it may be found in Florida and, like the "Spanish Moth," *Xanthopastis timais*, it may be found at points further north upon the Atlantic coast line.

And first as to the specific title. The moth is first figured by Cramer under the name *Phalæna hieroglyphica*; but at that date according to Guenée and the posthumous work of Moeschler upon the lepidopterous fauna of Porto Rico, p. 149, there was already a *Phalæna hieroglyphica* of Drury, a different species. The rule is: once a synonym, always a synonym, and at that time no second species of *Phalæna*, bearing the name of *hieroglyphica*, was permissable. It was then described as *Bombyx festiva* by Fabricius, Syst. Ent. 579, according to these same authorities. I find *Bombyx festiva* in Fabricius' Mantissa, II, 127, No. 157, 1787, which has no locality and is very briefly diagnosed as: *B. alis deflexis flavescentibus basi coeruleo maculatis apice nigro punctatis* and which is probably this species. But the same or a similar objection meets us with regard to the name *festiva*. There was already, according to Guenée and Moeschler, a *Bombyx festiva* of Hufnagel. The next name is *Diphthera elegans* of Hübner. Guenée objects to this name also, because there was another noctid called *elegans*, and this objection is sustained apparently by Moeschler. But there was no *Diphthera* of that name at the time (1810). It is well known that Guenée objected to the recurrence of specific names in the same lepidopterous family as liable to cause confusion. The genera being then imperfectly limited and the structural features not well understood, there can be no doubt that the evil of duplication was strongly felt. Yet there is no rule of nomenclature which would cover such change. It is now generally recognized in Europe, that a change, made in the same work by an author in a specific title proposed by himself, should be admitted. If admitted, then there is no limitation as to the name to be changed and, in the case of the changes of his own names, proposed by

Guenée in the 3d vol. of the Spec. Gén., it makes no difference, therefore, whether the change is made by him in the first or second use of the name. It must be followed and Guenée's request be granted, because the question of priority does not come into play. We have no right to change the second use of the name, when Guenée asks us to change the first. And there is no doubt that the use twice over of the same name in nearly allied genera is productive of confusion. In my own case I was led to propose to take "*nictitans*" as the type of *Apamea*, because Ochsenheimer had a species of this name in the genus which I wrongly took to be the common *Gortyna nictitans* L. sp., whereas it is a species or variety referable to the genus *Oligia*. But we have no right to change the specific names of other writers on this account and I think that the fourth name for our species, *fastuosa* of Guenée, must be referred to the synonymy. As there has been a neglect of the "Mantissa" of Fabricius, it may be well to include this citation in the synonymy of the species.

We have now arrived at what seems to be the correct name for the species, viz: *elegans* Hübn. But a difficulty meets us as to the generic title also. The generic title *Euglyphia*, from the Verzeichniss, is preoccupied by Hübner himself, with the exception of a single letter, in the name *Euglyphis*. What is evidently the same name, even when distinguished by the change or addition of a single letter, cannot be again admitted. Here the question is quite clear from the almost identity of the terms. We cannot admit *Euglyphis* and *Euglyphia*, any more than we can admit *Oenosandra* and *Oenosanda*. The similarity would inevitably create that confusion which the rule was intended to obviate. The reason given by Herrich-Schæffer, Schm. Cuba, III, 8, for retaining *Euglyphia*, that the prior *Euglyphis* was "probably" not a valid genus, has no bearing on the case. The nomenclator is not called upon to judge of the validity of biological groups. Guenée proposed the generic title *Noropsis* for our species, while Herrich-Schæffer objects (*l. c.*) that this term is too near *Norops*, already used in zoölogy. If it were so, it would be a reason for a new term, and it is a delicate question, since the derivation is identical. But I am inclined to believe that the two are sufficiently distinct and that we may rest content in the title *Noropsis elegans* Hübn. sp., for the pretty moth and let it go at that.

DESCRIPTIONS OF TWO NEW SMYNTHURIDS.

BY NATHAN BANKS.

We hardly expect to find in the tiny, soft-bodied spring-tails the curious peculiarities that often excite our wonder in the higher groups. The differences between species too often lie in uninteresting details. Sometimes the pattern of markings or the covering of scales attract our attention, but for the most part there is much similarity in appearance. In Florida the writer collected a Smynthurid distinguished from all known species by possessing a distinct median spine on the body; it has been described by Mr. Mac Gillivray as *Smynthurus floridanus*.

Some years ago while collecting on Long Island I found a species of *Smynthurus* with clavate hairs on its back; the specimen was in some way lost, but this year I have rediscovered it. Beside the clavate hairs, which separate it from all other species, this form is also peculiar in having between the eyes two tubercles. The other species which I describe below was swept from weeds on the top of the highest hill on Long Island; it is peculiar in having at the tip of the body horn-like tubercles. This form I have named in honor of that distinguished authority on our Thysanura, Mr. Mac Gillivray.

Smynthurus clavatus, sp. nov.

Length 1.2 mm. Head yellowish, with some irregular reddish spots and a median stripe between antennæ and eyes; antennæ yellowish, darker at the tips; abdomen rich brownish, rather purplish on the sides, anal tubercle yellowish; legs pale, mottled with brownish, furcula paler, but dentes somewhat purplish. (I have seen specimens darker throughout.) Head quite broad, with two conical elevations between the eyes, and a few small tubercles bearing short stiff hairs, simple hairs in front; antennæ very short, first joint no longer than broad, second twice as long, third as long as first and second together, fourth about as long as the third, consisting of two parts, the basal the longer, the apical part tapering, only a few scattered short simple hairs on the antennæ; dorsum of abdomen with scattered large clavate hairs, simple short spike-like bristles on the anal tubercle; legs short, with one claw and a tenant hair at tip (apparently), clothed with stiff short hairs; furcula short, dentes about as long as the diameter of the anal tubercle, curved and with a few simple hairs below (when in place), mucrones one-third the length of the dentes, rather stubby, with minute teeth along the lower edge.

One specimen under loose bark of a decayed log in a swamp, October, Sea Cliff, N. Y.; two others (darker in color) escaped me. Easily distinguished by the short antennæ, tubercles between eyes, and clavate hairs on dorsum.

Smynthurus macgillivrayii, sp. nov.

Length .9 mm. Pale yellowish, whitish below, a black stripe each side starting from the eye and running back to the base of the anal tubercle, on the abdomen it is very much maculose, broader, and connected to the one on the opposite side; legs and furcula pale hyaline. Body clothed with short fine simple scattered hairs, those on the abdomen recurved. Antennæ rather long and slender, the first joint no longer than broad, the second twice as long, the third as long as both together, the fourth twice as long as the third, indistinctly subdivided into eight or nine joints, the basal one the longer; legs of moderate length, slender, apparently but one claw and a tenent hair at tip; at the tip of the abdomen near the base of the anal tubercle there is on each side a distinct conical apparently corneus horn or tubercle, seen from above they project somewhat outward; furcula of moderate length, the dentes longer than the diameter of the anal tubercle, with some fine hairs below, the mucrones remarkably short and weak, about one-fourth as long as the dentes and very much smaller in diameter, minutely serrate below.

Several specimens swept from weeds on Harbor Hill, L. I., N. Y., in May. Readily recognized by the pattern, and the tubercles at tip of the abdomen.

NOTE ON MELITTIA SATYRINIFORMIS *Hübner*.

BY WM. BEUTENMULLER.

Melittia satyriniformis HÜBNER, Zuträge Exot. Schmett. 1825, III, p. 176, 453, 454; BOISDUVAL, Suites à Buffon, Nat. Hist. Lepid. 1874, p. 471

Ægeria cucurbitæ HARRIS, New England Farmer, Vol. VII, 1828, p. 33; Am. Journ. Arts and Sciences, Vol. XXXVI, 1839, p. 310; Ins. Inj. Veget. 1st Ed. 1841. p. 232; l. c. 2d Ed. 1852, p. 253; l. c. 3d Ed. 1862, p. 331; l. c. 4th Ed. 1863, p. 330; DOUBLEDAY, Harris' Corresp. 1869, p. 161; SCUDDER, Harris' Corresp. pp. 360, 385; RILEY, 2d Rep. Nox. Ins. Mo. 1870, p. 64; REED, Rep. Ent. Soc. Ontario, 1871, pp. 99–90; THOMAS (1st Rep.), 6th Rep. Nox. Ins. Ill. 1878, p. 41; MARTIN, (Thomas' 5th) 10th Rep. Nox. Ins. Ill. 1881, p. 107; SAUNDERS, Ins. Inj. Fruit, 1883, p. 361.

Trochilium ceto WESTWOOD, Cab. Orient. Ent. 1848, pl. 30, fig. 6.

Melittia ceto WALKER, Cat. Lepid. Het. B. M. pt. VIII, 1856, p. 66; MORRIS, Synop. Lepid. N. Am. 1862, p. 335; GROTE, Check List of Moths, 1882, p. 10; HY. EDWARDS, Ent. Amer. Vol. III, 1888, p. 223; BEUTENMULLER, Ann. N. Y. Acad. Sciences, 1890, p. 20; SMITH, Cat. Ins. N. J. 1890, p. 228; Rep. Ent. N. J. 1891, p. 385; l. c. 1893, p. 503; Econom. Ent. 1896, p. 259. KELLICOTT, Can. Ent. Vol. XXIV, 1892, p. 43 and 209; Insect Life, Vol. V, 1892, p. 82.

Melittia cucurbitæ WALKER*, Cat. Lepid. Het. B. M. p. VIII, 1856, p. 66 (as var.? *ceto*); PACKARD, Guide Study of Insects, 1869, p. 279 (and other editions); BOISDUVAL, Suites à Buffon, Nat. Hist. Lepid. 1874, p. 469; COOK, 13th Rep. St. Bd. Agricul. Mich. 1875, p. 116; COLEMAN, Papilio, Vol. II, 1882, p. 50; HULST,

* Walker places *cucurbitæ* as a var.? of *ceto*.

Bull. Brooklyn Ent. Soc. Vol. VI, 1883, p. 10; LINTNER, Country Gentleman, Vol. XLIX, 1884, pp. 477, 487 and 517; 2d Rep. Nox. Ins. N. Y. 1885, pp. 57–68; SMITH, Insect Life, Vol. IV, 1891, p. 30; BEUTENMÜLLER, Bull. Am. Nat. Hist. Vol. VIII, 1896, p. 113.

Trochilium cucurbitæ MORRIS, Synop. Lepid. N. Am. 1862, p. 139.

Ægeria (*Melittia*) *cucurbitæ* PACKARD, 9th Rep. U. S. Geol. Geograph. Survey (Hayden), 1877, p. 769; FRENCH (in THOMAS' 2d Rep.), 7th Rep. Nox. Ins. Ill. 1878, p. 173;

Melittia amœna HY EDWARDS, Papilio, Vol. II, 1882, p. 53; BEUTENMÜLLER, Bull. Am. Mus. Nat. Hist. Vol. VIII, 1896, p. 113.

In my paper entitled, "Critical Review of the Sesiidæ, found in America, north of Mexico," page 113 (Bull. Am. Mus. Nat. Hist., Vol. VIII.) I made the following statements regarding our common quash-borer *Melittia cucurbitæ*. "This well-known species was described by Harris as *Ægeria cucurbitæ*, and later by Westwood as *Trochilium ceto;* consequently the former name must be used. Doubleday (Harris corresp., 1869, p. 161) states that *Ægeria cucurbitæ* is *Melittia satyriniformis* Hübner, and, if so, this latter name would have precedence. Mr. Samuel Henshaw kindly examined for me Hübner's work (Zuträge Exot. Schmett., 1825), in the library of Harvard University, and writes me as follows: "The figure of *Melittia satyriniformis* differs from all *cucurbitæ* that I have seen in coloration; the abdomen is dark blue-black with light blue margins to lack segment and without a trace of the orange so conspicuous in *cucurbitæ*." In view of this fact I thought it best to retain Harris' name until more light could be obtained on the subject. Since then Prof. John B. Smith was kind enough to examine for me Hübner's Zuträge in the library of the Academy of Natural Sciences of Philadelphia, and he writes me as follows: "The insect which Hübner figures as *satyriniformis* is without any sort of question the moth of our common squash-borer. In this copy the coloring is good and represents our insect in a male specimen. The description is more full than usual and calls attention to several little details that correspond perfectly with our insect, and I have no doubt that Hübner's figure refers to our species."

It seems to me quite evident that the plates of different copies of Hübner's works are differently colored and misleading. I have no doubt as to Prof. John B. Smith's conclusions regarding the identification of *satyriniformis*, and I would propose that hereafter *M. cucurbitæ* be called *M. satyriniformis*. The type of *M. amœna* was kindly sent to me for examination by Prof. Snow, and it is absolutely the same as *satyriniformis*, there being no differences whatever between the two.

PRELIMINARY HANDBOOK OF THE COLEOPTERA OF NORTHEASTERN AMERICA.

BY WILLIAM BEUTENMULLER.

(Continued from Vol. IV, p. 49.)

The following description of the species of *Tachys*, may be of service to those desiring to identify their species. The genus needs revision and a comparison of the types of the species must be made before any synopsis can be prepared.

T. proximus *Say.*—Head and thorax piceous; antennæ rufous; thorax transversely subquadrate, slightly contracted behind; posterior angles rectangular; dorsal line distinct, basal ones indented; elytra testaceous with a black spot on the middle hardly attaining the margin, scutellar region dusky; striæ very obtuse, obsolete, wanting at sides and apex, impunctured, intervals convex; underside piceous, paler at tip; feet testaceous. Length 2.5 mm.

Habitat: New York, New Jersey, Pennsylvania, Ohio.

T. scitulus *Lec.*—Flavo-testaceous, glossy; head dark brown, front black; thorax convex, rounded at sides, retracted behind, hind angles obtuse, not rounded; margin behind the middle reflexed; elytra broader than the thorax, elongate, somewhat convex; flavo-testaceous with a dark brown fascia behind the middle; sutural stria entire, recurved behind; second stria abbreviated; remaining striæ almost obsolete; fourth interval with a large piliferous puncture before the middle and one near the apex; marginal stria much abbreviated anteriorly; underside rufo-piceous; legs testaceous. Length, 2.5 mm.

Habitat: New York, New Jersey, Pennsylvania, Ohio.

T. pumilus *Dej.*—Rufo-testaceous; thorax subquadrate, hind angles sub-acute; elytra oblong-oval, shining bluish behind; first and second striæ distinct, external striæ obsolete, with impressed punctures; underside blackish brown; legs testaceous. Length, 2 mm.

Habitat: Illinois, Florida.

T. corruscus *Lec.*—Piceous, with a bluish reflection, shining; thorax broader than long, sides rounded, slightly retracted behind, base at each side obliquely truncate; hind angles strongly obtuse, disc slightly convex; elytra much broader than the thorax, elongate, slightly narrower anteriorly, subconvex, with two piliferous punctures; sutural stria deep, entire, almost touching the base and strongly recurved be-

hind; remaining striæ obsolete; marginal stria abbreviated anteriorly, with four punctures at the humeri; legs testaceous. Length, 2.25 mm.

Habitat: New York and westward to the Rocky Mountains.

T. ventricosus *Lec.*—Piceous, glossy; head and thorax somewhat rufous; thorax slightly convex, transverse, somewhat narrowed on each side behind, hind angles obtuse, slightly prominent; elytra ovate, broader than the thorax, bipunctate, sutural stria deep posteriorly, remaining striæ obsolete; legs and antennæ flavo-testaceous. Length, 2.5 mm.

Habitat: New York and southward.

T. lævis *Say.*—Piceous, body tinted with rufous; head rather darker; antennæ paler at base; palpi whitish; thorax transversely subquadrate, hardly narrowed behind, lateral edge not excurved behind, angles slightly obtuse, angular, basal edge nearly rectilinear, dorsal line obsolete, basal ones wanting; elytra not punctured and without striæ, except an obsolete sutural one; legs testaceous. Length, 1.5 mm.

Habitat: New York, New Jersey, Pennsylvania, Ohio.

T. pallidus *Chd.*—Elongate, head and thorax reddish-testaceous, elytra darker, tips paler; legs palpi, and base of antennæ pale testaceous; thorax broader than long, sides rounded, feebly sinuate before the hind angles which are acute, surface slightly convex; elytra slightly wider than the thorax, sides feebly arcuate, sutural stria continuous, other striæ almost obsolete, near the inner basal angle is a small circular wart-like elevation. Length, 2.3 mm.

Habitat: New Jersey.

T. occultator *Casey.*—Reddish-tetaceous, head nearly black; legs pale testaceous; form robust; thorax with sides strongly rounded, feebly sinuate behind; posterior angle rectangular, prominent; median line feeble; elytra distinctly wider than the thorax, sides feebly arcuate, sutural stria strongly marked, arcuate without, then a feeble second stria, and beyond traces of a third stria; two minute punctures; marginal stria interrupted. Length, 2.8 mm.

Habitat: New Jersey (Cape May).

T. nanus *Gyll.*—Deep black, polished, antennæ brown, base and palpi and legs rufous; thorax nearly as broad as the elytra, somewhat narrowed and slightly sinuate behind; angles rectangular, basal edge rectilinear; elytra with dorsal stria, outer striæ obsolete, impunctured, lateral stria wanting; feet piceous. Length, 2.25 mm.

Habitat: N. E. America. Usually found under bark of decaying trees.

T. flavicauda *Say.*—Black, elytra from near the middle to the tip pale yellowish; antennæ, labrum and palpi pale rufous; thorax transverse, quadrate, broadest in the middle, not contracted behind, hind angles rectangular; basal edge rectilinear; elytra with striæ impunctured, wanting at the sides and tips, intervals convex; feet pale rufous; venter piceous at the tip. Length, 1.5 mm.

Habitat: N. E. America. Common under bark of decaying trees.

T. ænescens *Lec.*—Pale rufo-piceous, head dark brown, elongate; antennæ testaceous, apex fuscous; thorax transverse, quadrate, sides slightly rounded, base on each side oblique, hind angles obtuse and a little elevated, not rounded, disc convex; elytra flat, with bluish reflection, broader than the thorax, sides almost parallel, slightly narrower anteriorly, apex truncately rounded, external striæ obliterated, punctured, with 5 or 6 striæ moderately distinct, a little deeper behind, and nearly touching the base; lateral stria broadly interrupted; under side rufo-piceous; feet pale testaceous. Length, 2.25 mm.

Habitat: Arkansas, Georgia.

T. tripunctatus *Say.*—Piceous, head and thorax darker; antennæ light brown, paler at base; palpi yellowish; thorax with the dorsal line distinct, terminating on the basal margin in an impressed puncture, on each side of which is another rather smaller puncture, basal lines much dilated and deeply undulating the posterior edge of the thorax; elytra with about four rather obtuse striæ, not extending to the tip or base, lateral striæ wanting, except a marginal one which is interrupted, on each side of scutel and on the humeri is an indention. Length, 2.2 mm.

Habitat: New York, New Jersey, Pennsylvania.

T. vivax *Lec.*—Rufo-piceous, lateral margin of elytra rufo-testaceous, dilated at the apex and humeri, thorax transversely quadrate, hind angles acute, base foveolate, sides strongly rounded before the middle, straight behind the middle, disc moderately convex, longitudinal line fine, transverse anterior impression absent, posterior deep with three large punctures at the middle; elytra broader than the thorax, convex, sutural stria entire, third and fourth striæ obliterated behind; third stria with two punctures, marginal stria interrupted. Legs testaceous. Length, 2.5 mm.

Habitat: New York, Pennsylvania, Ohio and westward.

T. capax *Lec.*—Convex, shining black; antennæ rufo-piceous, legs rufo-testaceous; thorax strongly rounded at the sides, slightly

sinuate behind, angles rectangular and with a short carina, dorsal line moderately distinct, before the base are three punctures and at each side foveolate; elytra oblong-oval, a little broader than the thorax, bipunctate, sutural stria, deep and entire, second obliterated at apex, third less distinct and lateral stria obliterated. Length, 3.25 mm.

Habitat: New Jersey, District of Columbia and westward. Allied to *T. tripunctatus* and *vivax*, but is more convex than the first and has the sides of the thorax much more rounded than the second.

T. xanthopus *Dej.*—Blackish brown, shining, antennæ at base and legs testaceous; thorax transversely subquadrate, foveolate on each side posteriorly, angles rectangular; elytra ovate, two impressed punctures, two dorsal striæ distinct, external striæ obsolete. Length, 1.75 mm.

Habitat: New York, New Jersey and westward.

T. ferrugineus *Dej.*—Rufo-piceous, elytra paler at the sides, antennæ and legs testaceous; thorax strongly rounded at the sides before the middle, straight behind, disc subconvex, dorsal line fine, posterior transverse impression deep with three large punctures at the middle; at the angle deeply impressed; elytra convex, sutural stria deep and entire, second stria abbreviated at each end, third slightly evident with two punctures, marginal stria broadly interrupted. Length, 2.25 mm.

Habitat: Massachusetts, New York, New Jersey, Ohio, Illinois, Arkansas, Colorado.

T. incurvus *Say.*—Piceous, elytra with a honey yellow line from the humeri to the apex, where it is a little dilated, antennæ honey yellow; under side piceous; legs honey yellow; thorax a little contracted gradually to the base, dorsal line slight, basal transverse line deep and wrinkled; elytra polished, with a deep sutural stria, second stria obsolete and an interrupted stria on the lateral margin; a dilated indentation each side of the scutel, and a smaller one on the humerus. The dilated vitta on each side curves near its tip a little towards the suture. Length, 2 mm.

Habitat: N. E. America. Common; in the hills of the red ant.

T. nebulosus *Chd.*—Closely allied to *T. incurvus*, but is less convex, and the thorax is less distinctly rounded at the sides and less retracted behind the middle.

Habitat: Pennsylvania.

T. granarius *Dej.*—Pale rufo-piceous, shinning, antennæ at base and legs testaceous: thorax strongly rounded at sides, and retracted behind the middle, hind angles strongly obtuse, not rounded, basal

impression deep; elytra convex, smooth, with two fine punctures, sutural stria almost touching the base, marginal stria broadly interrupted. Length, 2 mm.

Habitat: Pennsylvania, District of Columbia, Georgia, Illinois. Resembles *T. xanthopus* but lacks the second sutural stria; it is also smaller and paler in color.

T. gemellus *Casey.*—Slender, convex, dark rufous, base of antennæ and legs testaceous; thorax broader than long, sides rounded; feebly sinuate before the hind angles, which are obtuse, median line fine; elytra scarcely wider than the thorax, sutural stria fine, with traces of a second stria. Length, 2.4 mm.

Habitat: New Jersey (Cape May).

T. dolosus *Lec.*—Pale rufous, elongate, convex; thorax rather flattened, quadrate, sides slightly rounded; posterior transverse impressions deep, finely punctate; base deep, more marked at the angle; elytra broader than the thorax, elongate, smooth, distinctly bipunctate; sutural stria almost touching the base, marginal stria interrupted. Length, 2.25 mm.

Habitat: Massachusetts, District of Columbia, Illinois, Missouri, Arizona, Texas.

T. fuscicornis *Chd.*—Entirely reddish brown, with the last seven joints of the antennæ fuscous. Thorax of the form of *granarius*, with the rounded sides directed obliquely towards the base; hind angles a little prominent and acute; transverse basal impressions less deep, and has but one puncture at the middle. Elytra elongate, like those of *dolosus*, but the sides are more rounded and above are more convex. Length 2.5 mm.

(*To be Continued.*)

SOME SYRPHIDÆ FROM LONG ISLAND.

By NATHAN BANKS.

The flies in the list given below were taken within a few miles of Sea Cliff, L. I., N. Y. The island, or at least this portion, is not so rich as the adjacent mainland in this group of insects. Specimens are usually more rare here, and species common elsewhere are unknown, or at least uncommon, here. Such, for example, is the case with the two large species of *Heliophilus*, with *Syrphus torvus*, *Mesograpta geminata*, and others. Along the shore we find two characteristic species. *Eristalis æneus* and *Triodonta curvipes*. Among the more interesting

species may be mentioned *Baccha aurinota*, *Pterallastes thoracicus*, *Paragus tibialis* and *Neoascia globosa*.

Paragus angustifrons Loew. One, September.
Paragus tibialis Fall. Several, July.
Chrysogaster nigripes Loew. A few, June.
Chrysogaster nitida Wied. Common, June, July.
Melanostomum obscurum Say. One, May.
Melanostomum mellinum Linn. A few, July.
Platychirus quadratus Say. A few, July.
Platychirus hyperboreus Stæg. Two, July.
Syrphus arcuatus Fall. One, September.
Syrphus americanus Wied. Several, May, June.
Syrphus ribesii Linn. A few, July.
Xantogramma flavipes Loew. Several, July.
Allograpta obliqua Say. Common, July, August.
Mesograpta marginata Say. Several, July.
Sphærophoria cylindrica Say. Common, July, August
Neoascia globosa Walk. One, May.
Sphegina lobata Loew. One, May.
Baccha lugens Loew. One.
Baccha fuscipennis Say. Common, July, August.
Baccha aurinota Walk. One, July.
Rhingia nascia Say. Common, July, August.
Volucella evecta Walk. Several, June, July.
Sericomyia chrysotoxoides Macq. One, October.
Eristalis tenax Linn. Common, April, July, Sept., October.
Eristalis æneus Fabr. Common, April, July.
Eristalis dimidiatus Wied. Several, April, July.
Eristalis transversus Wied. Several, May, July.
Eristalis flavipes Walk. Two, August.
Heliophilus conostomus Will. Several, June.
Pterallastes thoracicus Loew. One, May.
Mallota posticata Fabr. Several, July.
Mallota cimbiciformis Fall. One.
Triodonta curvipes Wied. Common, July, September.
Tropidia quadrata Say. Several, May.
Cynorhina analis Macq. Several, June.
Somula decora Macq. One, June.
Syritta pipiens Linn. Common, June, July, August.

A NEW ALEURODES FOUND ON AQUILEGIA.

BY T. D. A. COCKERELL.

Aleurodes aureocincta, sp. nov.

♂. Body about 1 mm. long, blackish, with some dull ochreous markings, a conspicuous yellow spot in front of base of wings. The body is very white-mealy, so as to appear grey. Legs yellowish grey, femora blackish, knees cream color. Hind femora extending as far as tip of abdomen; forewings about twice as long as body. Base of antenna very stout. Eyes completely divided. Wings snow white, with a suffused dusky spot at end of nervure, most obvious on anterior wings. Forewings with the main nervure apparently branched just as in *Aleurodicus*, but the seeming upper branch is only a fold, as may be seen on examination by transmitted light under a compound microscope. Lower branch of main nervure arising at extreme base, so that there are practically two nervures.

Pupa, a little over 1 mm. long, oval, dorsally black, with a very broad pale marginal area, which is pale lemon yellow in specimens which have given the imago; but white in others, probably parasitized, which have not hatched. The margin of the black area is dark brown. There is no fringe, but a dark line runs close to the margin, separating a narrow marginal area which looks like a very short fringe. On the dark portion of the pupa the segments are very distinctly marked; the light marginal portion is strongly but minutely corrugated all over, something like the skin of one's finger-tips under a lens; while margin is very finely striate and feebly scalloped. The vasiform orifice is approximately an isosceles triangle, with the angles rounded, the basal side straight, the caudad sides bulging. The operculum is rounded, much broader than long, somewhat less than the outline of a hemisphere; the lingua is broad and rounded at end, and projects beyond the operculum. The lingua and operculum together have much the outline of an English "cottage loaf" of bread, except that the operculum is too broad at base.

Habitat: On leaves of *Aquilegia*, Organ Mts., New Mexico (E. O. Wooton). It is severely parasitized by *Pteroptrix flavimedia* Howd. Mr. Howard (Revis. Aphelininæ, p. 19) in recording the parasite, leaves it to be inferred that the locality is Las Cruces; the *Aquilegia*, however, does not occur there.

A. aureocincta could not well be confused with any other North American species.

INTELLIGENCE SHOWN BY CATERPILLARS IN PLACING THEIR COCOONS.

BY WM. T. DAVIS.

Usually the cocoons of the American silk-worm moth (*Telea polyphemus*), fall off with the leaves in autumn, or a few dangle from the trees by a thread or two, which the caterpillars have accidently ex-

tended beyond the petioles of the leaves. During the storms of winter most of these unsecurely supported cocoons are also broken loose and complete their descent to the ground. We have found in early August an American silk-worm cocoon attached to the side of a house, about five inches from the ground, and on the 10th of last January, Mr. Chas. W. Leng and I, while walking on the ice in a Staten Island swamp, discovered one firmly woven to a forked branch of a rose bush, that stood in the water. It was as well secured to the forked branch as a *Cecropia* cocoon would have been. Of course to have fallen off with the leaves would have resulted in the death of this particular *Polyphemus*, and we presume that it was in some way the realization of this fact that caused the caterpillar to attach the cocoon so securely.

On the bushes and small trees that grow in the water on the margin of Silver Lake, on Staten Island, we have found a *Luna* moth cocoon and also an *Angulifera* cocoon firmly attached to branches. It is the habit of both of these species to construct their cocoons on the ground, but not being able to do so in the cases cited they did the next very best thing possible.

The above are perhaps not quite as interesting cases of the care taken by caterpillars to preserve their cocoons and themselves as the one mentioned in the "Proceedings of the Natural Science Association" some years ago under the caption of "Woodpeckers and Cecropia Cocoons." As is well known, *Cecropia* caterpillars spin their cocoons in a variety of places, often on fences, sometimes at the base of elder bushes and sometimes at the ends of swaying branches, when the food-plant happens to be a tree. The cocoons spun near the ground are often devoured by mice that gnaw through the silken coats to the edible pupa within. Those placed on tree branches are more safe from the attacks of mice, but are liable to be eaten by woodpeckers. On the 14th of January, 1888, I saw a Downy Woodpecker investigating a *Cecropia* cocoon in a white maple, the woodpecker thrusting its bill in and pulling it out of the cocoon quite frequently. After a while it flew to another cocoon a few feet away, but it being on such a small branch it was unable to successfully pick it open as the branch swayed up and down. It was then plain what a great protection it was to the insects to place their cocoons near the branch ends, though no doubt they are sometimes killed by the swaying of these branches during a storm.

When the woodpecker was gone, I cut the cocoon off, and found a small hole in its side quite near the branch, where it was easiest to drill because the silken fabric gave way the least to the strokes of the bird.

Cutting open the other side of the cocoon, I found that the pupa shell was sucked nearly dry of its contents. The *Cecropia* cocoons occur commonly on white maples and are generally placed near the ends of the long drooping branches, and it will be seen from the foregoing that it is probably the safest situation afforded by the tree. If a woodpecker is successful in making a hole into a cocoon, it is, nevertheless, sometimes disappointed at its contents. I have found a cocoon that contained the tough pupa case of the *Ophion* ichneumon fly, that had been drilled in the side by a woodpecker, and then abandoned, leaving the parasite unharmed.

THE CLASSIFICATION OF THE SATURNIIDES.

BY A. RADCLIFFE GROTE, A. M.

The publication by Dr. Dyar * of a critical notice of my recent paper (June, 1896) † on the *Saturniides*, affords me, in replying, the opportunity of briefly stating the characters which I found in the group. I founded the two families into which the superfamily naturally divides (any other division being in my opinion unnatural) as follows:

Vein IV_2 anastomosing with IV_1 .... SATURNIIDÆ.
Vein IV_2 out of the cross-vein .... AGLIIDÆ.

Perhaps some reason should have been given by Dr. Dyar for calling this fundamental difference in the neuration "artificial," while contrasting it with a "natural classification which should combine several such special ones." But this combination does not exist; it remains ideal. It reminds one of the hazy statement, that we must take characters from all parts of the insect, which procedure, without a strict weighing of values, would lead us nowhere. But the fact is, that although I have taken the structure of the Radius as the principal character, determining as it does the dichotomous division of the superfamily, I have not left out of sight the characters of differentiation offered by the larvæ and cocoons. I have worked out the gradual modifications of the Radius in the highest of the two families. I have not "selected" a random or arbitrary character, which would in the end fail. I have been obliged to take the fundamental character which carries with it all

* Can. Ent. XXVIII, 270.

† Mittheilungen aus dem Roemer Museum zu Hildesheim, No. 6.

the rest. And this proves the value, that the character does not fail.*

The adverse statement fails, when I show, that in the larval specialization (the diminution of the tubercles and armature), the antennal structure (the attainment of the equally lengthy pectinations), the neuration and the complexity in the attachment of the cocoon, a consonant direction is held and a perfectional advance throughout the *Saturniidæ* (including *Hemileuca*). Dr. Dyar's statement that I have transposed the position accorded by him to *Hemileuca* and *Aglia* is strictly correct and, as I try to show here, entirely defensible. The former, Dr. Dyar would place with the *Automeris* group on account of the stinging spines. But I prefer to consider the eversible glands and stinging spines of the caterpillar as here characters of convergence. Their presence is explainable by the consideration that both *Hemileuca* and *Automeris* have probably arisen or diverged from a common point nearer the basis of the phyllum. It is easier to see that the stinging spines are a subordinate character when we find them again in unrelated groups: e. g. *Apodidæ*. It is not possible for me to "suppose that vein IV_2 has moved towards IV_1 in *Hemileuca* separately from the type of *Attacus* and *Saturnia* where this process is congenital." Since I show that the type is fully attained in *Hemileuca*, it is plainly already congenital in the *Hemileucinæ*. The real morphological value of this "movement" is strangely underrated by Dr. Dyar. In reality it is profound. It amounts to a reorganization of the wing through the action of the Radius upon another pattern. In a paper subsequently read by me at the Frankfort meeting, I have tried to trace the process by which the lower and more generalized Agliid wing has passed into the higher, more specialized Saturniid type. The difference, as we now find it, is, relatively speaking, primary, palingenetic, not adaptory and secondary, as appears to me the change of the armature into stinging spines.

With reference to *Aglia*, which I believe to be a specialized and very much isolated type, I regard it as having left the main Agliid stem before the devolution of *Citheronia* as we now find this group. The loss of the pair of anal tubercles is to be set down solely to the *Citheroniinæ*. I do not derive *Algia* from *Citheronia*, but from the stem before *Citheronia*. Dr. Dyar charges me with entertaining more

* Since my paper went to press, the Roemer Museum has received additional material of South American *Saturniides* in all stages. In a paper read September 23d, at the Frankfort meeting, I show that in all the new material the characters pointed out by me hold good and sustain my general classification.

beliefs than I am conscious of possessing. I think I should believe with difficulty that a purely structural character, not correlated with habit, could be twice evolved in the same limited group. But I certainly have believed that the larva of *Aglia* is derived from the main stem of the family *Agliidæ* and quite independent of the *Saturniidæ*, and I believe this still. I think that these supposed contradictory larval characters can be straightened out to accord with my classification. It seems to me that Dr. Dyar has failed to notice my genealogical tree in its vertical aspect. My friend is not impressed as I hoped he might be with this magnificent specimen of zoölogical gardening. The vertical sequence is:

Attacus,
Saturnia,
Aglia,
Hemileuca,
Citheronia.

But I have separated the interlacing branches and show that there are two natural main stems, to the higher of which I most decidedly refer *Hemileuca*. *Aglia* has so grown over toward the Saturnians that Dr. Dyar fails to find its real issue. It does not follow, because Dr. Dyar has converted me fully to the value of the larval tubercles, that I should be equally fortunate, on a much more modest scale, and bring him round to the transposition of *Hemileuca* and *Aglia*. But I may hope to do so. In my original paper I am much indebted to Dr. Dyar for information, without which I could not have cleared the superfamily from alien families which had found place in it, nor have made my paper so complete. This gratitude is not in the slightest way impaired by my attempt to rescue my classification in this one particular from an adverse criticism. I am glad of the occasion to insist upon the seeming greater reasonableness of my views.

The difficulty in the way of believing that *Hemileuca* has independently attained the type of *Saturnia* lies in the physiological steps of the progress. It appears to Dr. Dyar to be merely an approaching of vein IV_2 to vein IV_1 at base, but I have shown that vein IV_2 remains nearly quiescent; it is the cross-vein which becomes transformed so as to form a continuous part of the vein.* It is part of a general mor-

* As I have shown, the cross-vein between IV_2 and IV_1 becomes oblique in *Aglia* and *Citheronia*, and shows a step towards *Saturnia* or *Hemileuca*; therefore, so far as the radial evolution is concerned, the two first are the lower. The affinity of *Aglia* and *Citheronia* lies in the fact, that in both groups the initiatory movement is displayed. Hence I derive *Aglia* from the main stem before *Citheronia* and after *Automeris* had left it.

phological change in the structure of the wing, tending to the obliteration of the cross-vein, the permanent attachment of the two upper branches of the median vein to the Radial series and of the lower branch to the Cubitus. Such a grand alteration in the pattern of the neuration must take place through a series of gradual steps, no one of which is fortuitous. To suppose that a member of the Aglid series of a low type (vein VIII of secondaries being retained) could attain such a stage as *Hemileuca* presents, presupposes a total subversion of structural sequence. No one, I think, who had studied the neuration attentively could entertain so violent a view. I close this reply to Dr. Dyar's otherwise kind notice with a confession of my inability to understand what it is in the spacing of the analytical table which makes it unintelligible, and a recapitulation of the characters of the higher structural groups of the *Saturniides* as established by me. I conclude that the classification is plain and obvious and is preferable to the obscure characters upon which Dr. Dyar would regard *Aglia* and *Hemileuca* as types of distinct families. So far as my studies go I have found no grounds for increasing the family types in the *Saturniides*, since all the genera examined by me fall naturally and easily into their places under one or the other of the two families limited in my paper.

Radius 5-branched..... ....SPHINGIDES.
Radius 3-4-branched.. SATURNIIDES.
(1) Vein IV_2 anastomosing with IV_1........................SATURNIIDÆ.
Cell open..ATTACINÆ. 1.
Cell closed.
Hind wings wanting vein VIII........................SATURNIINÆ. 2.
Hind wings with VIII present........................HEMILEUCINÆ. 3.
(2) Vein IV_2 from the cross-vein ....AGLIIDÆ.
Cell apically depressed.
Hind wings wanting vein VIII ....AGLIINÆ. 4.
Hind wings with vein VIII present........................CITHERONIINÆ. 6.
Cell rectangular..AUTOMERINÆ. 5.

In view of the radius being 5-branched and the internal vein (VIII) of the secondaries being retained throughout, I consider the *Sphingides* as lower, less specialized, than the *Saturniides*. But, since both groups are parallel, both rooting in the *Tineides*, their relative position in a linear arrangement is less important and, as I say in the "Systema," I have tried to keep the original sequence of Linné where this can be done without violence. In this case there may be other points, such as the specialized larvæ, the advanced prothorax and salient head, the narrow wings and the cylindrical and tapering abdomen, all fitting the

moths for their arrowy flight, which may balance the lower type of neuration in the Hawk moths. A result of my recent studies is the recognition of the compact structure of the *Sphingides*, so that I return to a view published by me a long time ago, but since practically abandoned, that the family *Sphingidæ* is probably only susceptible of tribal division. Such an instance does not occur a second time in the Lepidoptera, the series, certainly until we come to *Acherontia*, affording me no character which seems of sub-family value, corresponding in any way to the features which I have used as basis for these groups in the *Saturniides*.

OETA FLORIDANA *Neumoegen.*

BY HARRISON G. DYAR, PH.D.

Mr. Neumoegen briefly described this form (Can. Ent., xxiii, 123) as a variety of *O. aurea* Fitch, from the upper Indian River, Florida. I have been acquainted with the larva for some time at Lake Worth and Miami, but only recently bred them to imago. The larvæ live gregariously in a large, loose and open web among the leaves of the bitterwood tree, *Simaruba glauca*. They are unusually long and slender, of a dark brown color, and remaining motionless in the web, look like pieces of sticks accidently caught in a spider's web. The pupa is formed in the same location and is colored in the same manner.

O. floridana, larva. Slender, the abdominal segments elongated, one-half longer than thick, the thoracic segments not unusually elongated. Head rounded, scarcely bilobed, prominent and proportionately large; black, a labial line, bases of antennæ, and the tubercles of the setæ white; width 2 mm. Thoracic feet large and well developed, the abdominal ones small, short, the crotchets simple, distributed rather regularly over the surface of the plant, not in rows. Setæ simple, the subprimaries present. The prothoracic shield is united with the pre-spiracular tubercle, forming a large shield, bearing the usual nine setæ; subventral tubercle with three setæ. Mesothorax with ia and ib, iia and iib, iv and v approximate, iii remote, vi with two setæ. Abdominal setæ somewhat modified on account of the lengthening of the segments; iv and v are drawn far apart and, though not more out of line than is frequent, v is slightly the more dorsad of the two, which, together with its remote position, suggests somewhat the condition found in the Sphingidæ. Tubercles i and ii are nearly in line, iv is small and vi very large; vii is composed of one large and two small setæ above the base of the foot. Otherwise normal.

Color chocolate brown; a broad orange-brown dorsal band, reaching to tubercle ii and along joints 3 to 12, contains a dorsal row of small white spots and a similar border on each side; a row of tiny white dots above tubercle iii; another broad brown band subventrally, from tubercles v to vii and joints 4 to 11, bordered above by a narrow pulverulent white line; a dark spot on tubercle vi; spiracles pale; setæ white; length 25 to 30 mm.

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NEW GENERA AND SPECIES OF NORTH AMERICAN CURCULIONIDÆ.

By Martin L. Linell.

TRIBE ANTHONOMINI.

Anthonomus xanthoxyli, sp. nov.

Broadly oval, dark ferruginous, densely covered with small scales, variegated with white, gray, light and dark brown, with purplish reflection on the upper surface, and grayish white, somewhat intermixed with brown on the ventral surface and legs; beak coarsely substriately punctate, scaly and subopaque on the basal half, sparsely punctate, glabrous and shining on the apical half; antennæ slender, second joint one-half longer than the third, third equal to fourth; eyes large, protuberant, narrowly separated above; frontal fovea deep, elongate; head rugose, densely scaly; thorax transverse, rounded at the sides, broadly constricted at apex; disc densely covered with grayish and brown scales, a narrow dorsal line and a transverse one across the middle forming a white cross, the latter line broadly bordered by dark brown; elytra wider at the base than the thorax, slightly wider behind the middle, strongly declivous at apex; striæ fine, the punctures concealed by the scales; intervals nearly flat, the third at base and the suture on the declivity elevated; scutellum and two spots at its apex conspicuously white; scales of the disc variegated in grayish and pale brown, the extreme base dark brown, and of the same color is a very large triangular spot each side behind the middle not touching the suture and bordered with lighter gray; ventral segments each with a row of pale hairs; femora armed with a large triangular tooth, with scales variegated in brown and gray; tibiæ scaly at base, outwards with sparse grayish hairs; the anterior and middle tibiæ angulated one-third from base but not toothed, the posterior ones simple; tarsi sparsely hairy, pale; claws black. Length, 2 mm.

Numerous specimens collected by Mr. E. A. Schwarz at San Diego, Texas, on *Xanthoxylum pterota*, living in the seeds. Type No. 1399, U. S. N. M.

This species belongs in the subgenus *Anthonomocyllus* of Dietz, characterized principally by the widely separated middle coxæ, and is

closely allied to *A. elegans* Lec., but is smaller, less variegated and the tibiæ are unarmed.

Anthonomus brevirostris, sp. nov.

Subovate, robust, black, shining, with a slight æneous lustre, clothed with long white appressed hairs, very sparsely above, densely beneath; beak very short, scarcely longer than head and thorax, glabrous, opaque and coarsely punctato-striate behind the insertion of the antennæ, shining and sparsely punctate at apex; antennæ inserted far beyond the middle, slender, entirely testaceous, sparsely pubescent; first joint of funicle short, strongly clavate, second slender, much longer than third; following joints gradually wider; eyes feebly convex, free behind; head short, sparsely and finely punctulate, finely but deeply sulcate above the eyes; thorax broader than long, sides broadly rounded from the base, apex broadly but feebly constricted, disk very sparsely, comparatively finely punctate, each puncture with a long scale-like hair; scutellum very conspicuous by dense white scale-like hairs; elytra oval, about one-fourth wider at base than the thorax and one-half longer than wide, with striæ of distant, deep but rather fine punctures; the striæ impressed only at the side-margin and apex; intervals nearly flat, obsoletely punctulate; surface with very sparse long white hairs, condensed into spots on the base of the sixth (sometimes also at the apical fourth) and at the middle and apical fourth of the fourth intervals; pubescence of the ventral surface generally dense but all the sutures and the median line of metasternum and abdomen sparsely pubescent; legs sparsely hairy, piceous, posterior femora at base, apical half of the tibiæ and the tarsi testaceous; all the femora sharply toothed; anterior tibiæ bisinuate internally, incurved at apex; tarsi short, the first joint slightly longer than the second. Length (from apex of thorax), 2 to 2.3 mm.

Four examples collected at Brownsville, Texas, by Prof. C. H. T. Townsend. Type No. 1400, U. S. N. M.

This species belongs in the *nigrinus* group of Dietz, characterized by the third and fourth ventral segments equal in length, and should be placed with *A. faber* Dietz, from which it is readily distinguished by the sparser and finer punctuation.

Anthonomus testaceosquamosus, sp. nov.

Oblong oval, pale ferruginous, densely clothed with oval, uniformly colored, pale yellowish scales; beak very short, feebly curvate, dark ferruginous, shining; basal part to the insertion of the antennæ deeply punctato-striate, clothed with sparse scale-like hairs and some oval scales at the base, apical part glabrous, confusedly punctate; antennæ slender, testaceous with infuscate, densely pubescent club; second joint of funicle twice as long as the third; eyes large, convex; front flattened, fovea deep; thorax much wider than long, strongly rounded at the sides and broadly constricted at apex; base strongly bisinuate; surface densely and coarsely punctate; scales nearly uniform in size, oval, somewhat more condensed on the median line. Scutellum densely scaly, not different in coloration; elytra at base much wider than thorax, oval, not wider behind; striæ fine, concealed by the scales; intervals flat; scales

narrow, hairlike; anterior thoracic opening very oblique; prosternum short in front of the coxæ; scales of ventral surface oval, very dense, more narrow and less dense on the last ventral segments; legs pale testaceous, all the femora armed with a sharp tooth, tibiæ feebly bisinuate, claws black. Length (from apex of thorax), 2.5 mm

Three examples collected at Brownville, Texas, by Prof. C. H. T. Townsend. Type No. 1401. U. S. N. M.

This species should enter the *squamosus* group of Dietz next to *A. squamosus* Lec., from which it differs by its much smaller size and rounded sides of the thorax. The strongly shining beak will readily distinguish it from *A. tectus* Lec.

Brachyogmus, gen. nov.

Claws simple, divergent; hind tibiæ mucronate; prosternum short in front of the coxæ; antennal scrobes straight, directed against the eyes, but abbreviated long before reaching them; form convex, thorax narrow.

Brachyogmus ornatus, sp. nov.

Subovate, piceous, the ground color entirely concealed by large rounded scales, variegated with white, black and ferruginous; beak somewhat longer than head and thorax, cylindrical, moderately stout, slightly curvate, at base densely scaly with white and ferruginous, outwardly shining piceous; scrobes commencing two-fifths from the apex, broad and deep for about one-half the distance towards the eye, then gradually evanescent; antennæ slender; scape reaching the eye, suddenly clavate at apex, ferruginous; funicle as long as the scape, seven-jointed, darker ferruginous, each joint bearing a whorl of long stiff white hairs, first joint clavate, twice as long as the second, second to seventh subequal in length, gradually but slightly wider; club elliptical, piceous, densely pubescent; eyes moderately large, feebly convex, rounded; front wide between the eyes, depressed, with ferruginous scales; head short, the scales white, forming three broad longitudinal stripes; thorax as broad as long, very convex, broadly not strongly constricted at apex; sides strongly rounded; base bisinuate; scales white, variegated with ferruginous, on each side of the white median line a broad black stripe, variegated with ferruginous, interrupted before the apex; scutellum purely white; elytra at base fully one-third wider than thorax, twice as long as broad, slightly wider behind the middle; humeri prominent with arcuate margin; striæ narrow, deeply impressed, the punctures concealed; intervals flattened, the sutural elevated towards apex; scales variegated in white, ferruginous, black and metallic green, in the basal region around the scutellum mostly ferruginous; a humeral spot, a broad band across the suture before the middle and numerous, often rectangular, spots, forming two irregular transverse fasciæ posteriorly, are dark mixed with black and metallic; ventral surface with the scales white, mixed with ferruginous at the sides. The first four abdominal segments gradually shorter, the fifth equal to the fourth; pygidium concealed in the female, partly exposed and perpendicular in the male; femora clavate, obtusely, toothed, variegated with white and ferruginous scales; tibiæ stout, strongly mucronate at apex, variegated with white and metallic green scales, towards apex with white hairs replacing the scales; tarsi short, narrow,

piceous, clothed with white hairs; first joint scarcely longer than second, the third slightly wider; claws strong, black. Length (from apex to thorax), 2.2 mm.

Four examples collected in Los Angeles Co., Cal., by Mr. D. W. Coquillett. Type No. 1402 U. S. N. M.

This genus may be placed near *Epimechus* Dietz, from which it differs in the abbreviated scrobes and the narrow thorax.

TRIBE BARINI.

Stenobaris, gen. nov.

Pygidium completely exposed, oblique; antennæ inserted before the middle of the beak, club oval, densely pubescent, as long as the preceding four joints combined, second funicular joint as long as the next two combined; tarsal claws very small, free; anterior coxæ large, very narrowly separated; prosternum slightly convex, transversely impressed at the apical margin; beak not separated from the head, slender, cylindrical, arcuate, as long as the thorax; body slender, sparsely clothed with linear scales, not condensed into spots.

This genus should take its place near *Plesiobaris* Casey, from which it differs by the slender form, narrow prosternum, longer second funicular joint and the vestiture not forming any spots.

Stenobaris avicenniæ, sp. nov.

Elongate, lanceolate, shining, æneous, beak, antennæ and legs rufo-ferruginous; beak nearly smooth, finely punctate on the sides at base; antennæ slender, scape not reaching the eye; club piceous, the basal joint large, composing one-half of the mass; eyes feebly convex, narrowly separated above; head æneous, alutaceous, coarsely but not densely punctate, rugose and scaly between the eyes; thorax cylindrical, as long as wide, narrowed but not constricted at apex; disc very coarsely and densely punctate, each puncture bearing a narrow yellowish-white scale at the bottom, a few broader, irregular, smooth intervals between the punctures near the middle; elytra at base distinctly broader than thorax, with prominent humeri, nearly two and a-half times as long as broad; sides parallel for four-fifths the length, then arcuate to apex; striæ fine, coarser at the base, subobsoletely punctate; intervals flat, remotely transversely strigose, each striga with a small puncture, bearing a long narrow grayish-white scale; ventral surface with squamiferous punctures, rather dense on the thoracic segments, sparser on the abdomen; legs with sparse scale-like hairs; tarsi very short; fimbriate. Length, 3 mm.

Type No. 1403, U. S. N. M. Five examples in the collection of Messrs. Hubbard and Schwarz, two of which they have presented to the National Museum. They were collected at Punta Gorda, Fla. (July 14), on black mangrove (*Avicennia nitida*) and were labelled by Mr. Schwarz with the manuscript names used above. In form this insect is nearly as slender as the species of *Barilepton*.

Onychobaris rufa, sp. nov.

Oval, convex, shining, entirely rufo-ferruginous, clothed with very short, inconspicuous setæ; beak shorter than the thorax, strongly arcuate, not tapering to apex, second funicular joint one-half longer than the third; thorax scarcely wider than long, strongly constricted and tubulate at apex; sides distinctly tumid between the constriction and the middle, fully as broad there as at the base, subsinuate behind the middle; disc punctured as in *O. subtonsa* Lec., the punctures circular, less than one-third the width of the scutellum, not in contact on the middle but rugosely confluent at the sides; elytra at base not wider than thorax, scarcely one-half longer; sides behind the humeri decidedly convergent; striæ abrupt, not very broad, obsoletely punctate; intervals flat, twice as wide as the grooves, coarsely and closely but not deeply punctate, the third and fifth wider with the punctures confused, the others with single rows; anterior coxæ small, more remote than their own width; prosternum nearly flat, slightly impressed at the constriction, with two deep punctiform grooves and two obsolete rudimentary carinæ each side, the exterior one very short; abdomen sparsely punctate at the middle, densely at the sides and apex; tarsi with the first joint as long as the two following, the terminal joint as long as the three basal joints combined. Length, 3.8 mm.

Two examples were collected in the sand-dunes at Great Salt Lake, Utah (June 25), by Messrs. Hubbard and Schwarz, who have presented one of them to the National Museum. Type No. 1404, U. S. N. M.

Pachybaris xanthoxyli, sp. nov.

Form and size of *P. porosus* Lec.-Robust, convex highly polished, black, elytra, antennæ and legs rufo-piceous; vestiture very sparse of snow-white scales, smaller and narrow on the ventral surface, larger and obovate on the elytra and sides of thorax; beak slender, strongly arcuate, coarsely punctato-striate, separated from the front by a deep transverse impression; the prolongation of the antennal scrobes towards the apex broad and deep, not gradually narrowed as in *P. porosus;* head sparsely and finely punctate; thorax strongly constricted, almost tubulate at apex; disc finely and sparsely punctate, a line of coarse punctures on the apical constriction, the inflexed sides coarsely rugose; basal lobe obsoletely emarginate; scutellum small, trapezoidal; elytra with narrow, deeply impressed, feebly crenulate grooves; intervals very broad and flat, each with a single series of small scale-bearing punctures; prosternum in front of the coxæ deeply canaliculate. Length, 4 mm.

One example collected by Mr. E. A. Schwarz on *Xanthoxylum pterota*, at San Diego, Texas. Type No. 1405, U. S. N. M.

By the deep frontal groove this species approaches the genus *Linonotus* Casey, but the small scutellum and the want of antecoxal processes associate it more naturally with *Pachybaris*.

Oligolochus robustus, sp. nov.

Oval, convex, robust, shining, rufo-piceous; beak, antennal funicle and legs rufous; vestiture of dorsal surface consisting of large yellow scales, forming three broad longitudinal vittæ on the thorax, the median vitta inturrupted at middle, smaller spots

on the base of the third and fifth intervals and scattered scales along the third, fifth, seventh and ninth intervals; ventral surface and legs sparsely clothed with smaller yellowish-white scales; beak slender, a little longer than thorax, arcuate near the base, distinctly flattened at apex, strongly, unevenly punctate; antennæ inserted a little beyond the middle, scape not reaching the eye, funicle with the first joint longer than next three combined, the second somewhat longer than the third; club large, oval, densely pubescent, with the basal joint one-half of the mass; eyes flat, widely separated above, with a few large erect yellow scales at the anterior margin on the base of the beak; head separated from the beak by an obsolete constriction, alutaceous, sparsely and finely punctulate; thorax one-third wider than long, rounded on the sides, broadly constricted at apex; disc sparsely punctate at the base, more coarsely and rugosely at the constriction and on the sides; the median line smooth, entire, fusiform; a large smooth space on the disc each side, approaching the base; scutellum small, glabrous; elytra scarcely wider than thorax, slightly longer than wide, broadly arcuate from base to apex; humeri not prominent; striæ broad, deep and abrupt; intervals flat, scarcely wider than the striæ, each with a sigle row of rather coarse punctures; ventral surface coarsely and rather densely punctate; prosternum flat, separating the coxæ by about one-half their width, apical constriction entire. Length, 2.6 mm.

Type No. 1406, U. S. N. M. One example from New Jersey, presented to the National Museum by Mr. Chas. Tunison, of New York. Another specimen from the District of Columbia is in the collection of Messrs. Hubbard and Schwarz. The species resembles *O. convexus* Lec. in sculpture, but may be readily distinguished by the robust form, yellow scales and the humeri not being prominent.

Oligolochus longipennis, sp. nov.

Elongate, ovate, narrowed behind, less convex, shining, rufo-piceous, beak, antennæ and legs rufous; vestiture of narrow white scales, sparse and nearly uniformly distributed; beak slender, a little longer than thorax, regularly arcuate, scarcely flattened at apex, less coarsely, unevenly punctate; basal constriction feeble; a few erect longer scales at the margin of the eye; antennæ inserted distinctly beyond the middle of the beak; scape far from reaching the eye; first joint of funicle as long as the next three combined, the second a little longer than the third; head alutaceous, very sparsely and minutely punctulate; thorax slightly wider than long, sides slightly tumid before the middle, nearly parallel to base, broadly constricted at apex; disc coarsely and densely, on the sides and at the constriction rugosely, punctate; a smooth median line, abbreviated each end; the white scales uneven in size, on the sides and along the base larger, on the middle of the disc very small and inconspicuous; scutellum small, with a couple of scales; elytra not wider than thorax, one-half longer than wide, strongly narrowed from the humeri and compressed on the sides near the apex; humeri not prominent; striæ deep and abrupt, moderately wide; intervals flat, each with a row of rather coarse scale-bearing punctures, the scales forming a spot on the base of the third interval; ventral surface coarsely and densely punctate; prosternum flat, separating the coxæ by one-half their width, apical constriction entire; legs sparsely punctate and scaly. Length, 2.8 mm.

One example from Burnett Co., Texas.

Type in the collection of Messrs. Hubbard and Schwarz.

This species is easily distinguishable by the densely punctate thorax, the uniformly distributed scales and the elongate form, tapering behind.

Zygobaris cœlestina, sp. nov.

Robust, subrhomboidal, convex, glabrous, strongly alutaceous, opaque, intensely dark blue; beak separated from the front by a shallow depression, short, arcuate, cylindrical slightly flattened at apex, shining, sparsely punctate, basal half bluish green, apical half piceous; mandibles short, decussate, strongly bifid at apex; scrobes deep, directed inferiorly; antennæ inserted a little beyond the middle of the beak, ferruginous, the scape not quite reaching the eye; funicle stout, the first joint as long as the three following combined, the second and third subequal, the outer joints gradually wider; club oval, pointed, finely tomentose; eyes large, flat, widely separated above; frontal fovea small, punctiform; head globose, sparsely and finely punctulate; thorax scarcely wider than long, conical; sides somewhat rounded; apical constriction broad and feeble; disc sparsely and finely punctate, more coarsely at the sides, without trace of median line; scutellum small, smooth, shining green; elytra at base slightly wider than thorax, gradually, moderately narrowed behind, broadly rounded at apex; humeral callus at base of seventh interval conspicuously elevated; striæ linear, distinctly impressed, with remote fine punctures, much larger at base between the scutellum and humeral callus; intervals flat, each with a single series of remote, small, submuricate punctures; thoracic segments beneath coarsely and deeply but not very densely punctate, each puncture at the bottom with a small narrow white scale; prosternum flat, separating the coxæ by their own width, with a small shallow depression near the apical margin enclosing two large deep punctures; ventral segments finely, very sparsely, apical half of the fifth very densely, punctate; legs bluish green, alutaceous as the body, sparsely finely punctate, each puncture with a short white hair; tarsi short, ferruginous, fringed with grayish hairs; third joint moderately broad, bilobed; claws small, distinctly connate at base. Length, 4 mm.

Type in the collection of Messrs. Hubbard and Schwarz, taken at Cocoanut Grove, Fla. (April 25). Mr. Schwarz informs me that another specimen is in the collection of Dr. Horn.

Catapastus signatipennis, sp. nov.

Robust, rhomboidal, convex, black, somewhat shining; antennæ and legs piceous; beak as long as thorax, strongly curvate, piceous; base thickened, coarsely rugose and squamulate, the basal constriction distinct; apex glabrous, punctato striate; antennæ inserted beyond the middle of the beak; scape not reaching the eye; first joint of funicle as long as the next four combined, second equal to third; club oval, large; head nearly glabrous, alutaceous, obsoletely punctulate; thorax wider than long, conical, distinctly constricted at apex, coarsely and densely punctate, densely covered with rounded scales, forming a broad brown band along the middle and yellowish white on the sides; a denuded spot on each side of the basal lobe; elytra distinctly wider than thorax, broadly rounded and feebly convergent on the sides,

rounded at apex; striæ narrow but abrupt; intervals broad, flat, sparsely, confusedly and subrugosely punctate; vestiture sparse, of brown narrow scales and broader yellowish ones; the latter forming a spot at the base of the third interval and a large W-shaped mark across the suture at middle; ventral surface rather sparsely punctate, each puncture bearing a narrow white scale; prosternum separating the coxæ by one-half their width, broadly sulcate, the sulcus deeper in front and with two deep punctiform foveæ at the constriction; legs sparsely punctulate, each puncture with a narrow white scale, the femora exteriorly towards apex with brown scales; tarsi very short, fringed with white hairs; claws parallel, connate at base. Length, 2 mm.

Four examples collected at Key West, Fla., by Mr. E. A. Schwarz, two of which are presented to the National Museum by Messrs. Hubbard and Schwarz. Type No. 1407, U. S. N. M.

Catapastus albonotatus, sp. nov.

Rhomboidal, convex, piceous black, very sparsely clothed with scattered white scales, very narrow and small on the ventral surface and larger but still sparser on the thorax and elytra, collected into small spots on the base of the second interval, on the base of thorax opposite the humeral umbone and on the base and apex of the episterna of metathorax; beak thick, not flattened at apex, strongly curvate and abruptly bent at middle, coarsely striato-punctate, with a few minute scales towards the base; basal constriction obsolete, the upper margin of the eye with a white scale; antennæ inserted beyond the middle of the beak, piceous, the scape not reaching the eye; funicle with first joint obconical, second scarcely longer than third; club large, oval; head sparsely punctulate; thorax as long as wide, slightly rounded at the sides, feebly constricted at apex, only moderately coarsely punctate, the punctures separated by about their own diameter; smaller scales wanting, the large white scales about a dozen outside of the basal spot; scutellum glabrous; elytra at base wider than thorax; sides behind the humeri strongly convergent; striæ narrow, remotely not conspicuously punctate; intervals flat, each with a series of small remote punctures and fine transverse strigæ; the white scales mostly on the third, seventh and ninth intervals; ventral surface sparsely punctate; prosternum separating the coxæ by nearly their own width, broadly impressed, with two punctiform foveæ at the constriction; legs piceous, sparsely punctulate; tarsi short, ferruginous, fringed with white hairs. Length, 1.7 mm.

Type No. 1408, U. S. N. M. One specimen in the National Museum from Lake Worth, Fla., presented by Mr. Ottomar Dietz, of New York; another one exactly similar in the collection of Messrs. Hubbard and Schwarz from Key West, Fla. In the latter collection is a third specimen also from Key West, which has more numerous scales above, condensed into three vittæ on the thorax; the spots are diffused and the beak and legs ferruginous, but there is no difference in sculpture. The glabrous scutellum with a spot each side at once distinguishes this species from *C. conspersus* and *C. diffusus*.

LIFE HISTORIES OF THE NEW YORK SLUG CATERPILLARS.—X-XI.

PLATES III-IV.

By HARRISON G. DYAR, A.M., PH.D.

Euclea delphinii *Boisduval.*

1797—*Phalæna cippus* ABBOT & SMITH, Lep. Ins. Ga. II.
1832—*Limacodes delphinii* BOISDUVAL, CUVIER'S An. Kingdom (Griffith), pl. CIII, fig. 6.
1841—*Limacodes cippus* HARRIS, Ins. Inj. Veg. 303.
1854—*Limacodes querceti* HERRICH-SCHAEFFER, Ausser. Schmett. fig. 174.
1854—*Limacodes quercicola* HERRICH-SCHAEFFER, Ausser. Schmett. fig. 175.
1855—*Euclea cippus* WALKER, Cat. Brit. Mus. pt. V, p. 1143.
1855—*Euclea viridiclava* WALKER, Cat. Brit. Mus. V, 1154.
1860—*Euclea pænulata* CLEMENS, Proc. Acad. Nat. Sci. Phil. XII, 159.
1860—*Nochelia tardigrada* CLEMENS, Proc. Acad. Nat. Sci. Phil. XII, 160.
1864—*Euclea monitor* PACKARD, Proc. Ent. Soc. Phil. III, 337.
1864—*Euclea ferruginea* PACKARD, Proc. Ent. Soc. Phil. III, 337.
1864—*Euclea bifida* PACKARD, Proc. Ent. Soc. Phil. III, 338.
1882—*Euclea querceti* GROTE, Check List, 17.
1882—*Euclea quercicola* PILATE, Papilio, II, 67.
1887—*Euclea elliotii* PEARSALL, Ent. Amer. II, 209.
1891—*Euclea cippus* DYAR, Trans. Am. Ent. Soc. XVIII, 151.
1891—*Euclea cippus* var. *interjecta* DYAR, Ent. News, II, 61.
1891—*Euclea cippus* SMITH, List Lep. 28.
1892—*Euclea querceti* KIRBY, Cat. Lep. Het. I, 547.
1894—*Euclea delphinii* NEUMOEGEN & DYAR, Journ. N. Y. Ent. Soc. II, 67.

LARVA.

1832—BOISDUVAL, Cuvier's An. Kingd. (Griffith), pl. CIII, fig. 7.
1860—CLEMENS, Proc. Acad. Nat. Sci. Phil. XII, 160.
1878—ANDREWS, Psyche, II, 272.
1881—FRENCH, Papilio, I, 144, 145.
1890—PACKARD, 5th Rept. U. S. Ent. Comm. 144.
1891—DYAR, Trans. Am. Ent. Soc. XVIII, 152.
1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 89, 101.
1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 214.
1895—COMSTOCK, Man. Stud. Ins. 223; fig. 258.

SYNOPSIS OF VARIETIES OF THE MOTH IN NEW YORK.

Form delphinii. Green confined to a small triangular basal patch and subapical dots (plate III, fig. 1).

Form querceti. The basal green patch has a short projection on the outer side (plate III, fig. 2, left wing).

Form interjecta. A row of green dots connects the basal and subapical green marks (plate III, fig. 3, right wing).

Form viridiclava. The green forms a continuous band, bordering the cell, notched on the outer side (plate III, fig. 4).

Form elliotii. The green band encroaches on the cell, or even surrounds the discal dot (plate III, fig 5).

SYNOPSIS OF VARIETIES OF THE LARVA.

Form A.—Flesh colored, horns and ridges bright red shading to pinkish; black lines all present, waved, confluent, forming irregular areas about the glandular dots; no quadrate spots; often no detachable spines (plate III, fig. 9).

Form B.—Sordid purplish, the black lines shaded; horns and ridge broadly bright ferruginous, broken on the interspaces, 6–7, 9–10 and 11–12 by quadrate dark brown spots.

Form C.—Dorsum sordid purplish, sides green; marks as in form B (plate III, fig. 6).

Form D.—Green, the black lines faint; horns and ridge yellow, broken by quadrate spots as in form B (plate III, fig. 8).

Form E.—Green, the ridge and horns red; quadrate brown spots on joints 3–4, 4–5, 6–7, 9–10 and 11–12 (plate III, fig. 7).

SPECIAL STRUCTURAL CHARACTERS.

These characters have been already given for the Florida form (see Journal N. Y. Ent. Soc., iv, 125). In the New York forms there are usually no caltrope patches on the subdorsal horns of joint 13. The patch on the lateral horn of joint 12 is present when there is only one pair of detachable spines (on joint 13), but absent when the second pair is present, and even absent in stage vii, before the spines have appeared, so that it may be determined in this stage whether there will be one or two spine patches. The second pair of spine patches appears above this horn (lateral of joint 12) and replaces the caltropes functionally; but probably the spines are not homologous with caltropes as we formerly supposed (Journal, iv, 3, foot note) since both may be present on the same horn and the caltropes abruptly disappear before the spines, not being converted into them.

Our larvæ do not hide by day so persistently as the Florida form, though the habit is present in some degree.

AFFINITIES, HABITS, ETC.

The range of variation in the moths as they occur in New York is illustrated on the plate (figs. 1 to 5). The variation of the amount of green on the fore-wings is from *delphinii*, the minimum, to *elliotii*, the maximum. The ground color also varies from dark ferruginous brown

to ocherous brown and the bright red shade bordering the green outwardly may be distinct or wanting.

The forms have a certain dependence on locality. In the Hudson valley the *delphinii* form predominates, rarely becoming as green as *viridiclava*; on Long Island the tendency is towards green and the *elliotii* form is frequent. The species ranges to the South, our locality being toward its northernmost extension. In the southern part of Florida the *delphinii* form appears, approaching the true *cippus* of Dutch Guayana. According to Cramer's figure, *cippus* is a brown moth with three green patches, the third at the end of the cell, apparently. This is a form which our species has no tendency to assume, and if it really extends into South America, it is more likely to be represented by *Euclea æmilia* Stoll, which differs from the *delphinii* form in having the basal patch yellow, instead of green, a variation which is occasionally indicated in New York specimens.

Euclea dicolon Sepp, is also nearly related, but has a very differently colored larva. In the Mississippi valley and Texas, the forms *pænulata* and *incisa* occur. The larva of the latter is unknown and I have no opinion as to its relation to our species; but the larva of *pænulata* as described by Professor French does not differ from those which have produced *viridiclava* and *elliotii* here. The moth of *pænulata* is only slightly more green than *elliotii* and it seems probable that it is a variety of our species.

The variation in the larvæ is considerable. In our preliminary synopsis (Journal III, 146), we recognized *pænulata* as distinct from *delphinii* on the characters of the number of detachable spine patches and coloration; but further experience renders this view untenable. There is a certain local tendency coupling the forms of larvæ with the moths as indicated in our table. In the Hudson valley the larvæ are generally green with red or yellow horns, the subdorsal band broken by brown spots and the four spine patches well developed. On Long Island the terra cotta form prevails, though not exclusively, without the brown spots and with feebly developed spine patches. However, rarely the terra cotta colored form has four spine patches; such a larva produced a moth of *elliotti*. Then the Florida larvæ, having the characters of *pænulata* in the unbroken subdorsal band and single pair of spine patches, but the green color of *delphinii*, have recently been described in this journal. The moths were *delphinii*, and thus all the differential characters have vanished, leaving a single variable species with a tendency towards local forms.

The species is single brooded in New York. The moths fly in the last of June and in July. The eggs are deposited in the evening, before ten o'clock, usually singly, or but few together, not in the rather large patches of *Sibine*. They hatch in seven days. The larvæ pass through the usual eight stages, occasionally nine. In this case a stage is interpolated between the last two. It usually is like stage VII, but may be like the last stage with the presence of detachable spines. The first stage is quickly passed through without feeding, but afterwards development is more slow. Mature larvæ may be found in September.

The coloration of these larvæ is much less conspicuous than that of *Sibine stimulea* and their defensive armor is weaker in proportion, the spines being distinctly less venomous.

Miss Morton has obtained fertile eggs of the Long Island form from cocoons collected by Mr. Doll. The youngest larvæ which I have found in the field have been in stage III.

CRITICISM OF PREVIOUS DESCRIPTIONS.

The references to Abbot & Smith, Harris, Morris, Packard and Duncan, given in Edwards' catalogue of transformations of N. A. Lepidoptera under the heading *E. cippus*, do not refer to this species, but to *E. indetermina* or *S. stimulea*. The present references are to descriptions or figures of the mature larva and cover the principal colorational forms. This larva has been on the whole so slightly investigated that there is little of a positive nature to correct. Dr. Packard's latest description is full and very good. He says "there seem to be no caltropes . . . in the cuticle of this genus," but above (page 90) he describes "a pale brown patch like a mass of sand" on the upper side of the lateral horns of joints 6 to 11, which are really the patches of caltropes, though he failed to recognize them. The detachable spines are correctly located, but not described in detail. The lateral horns are not referred to their respective segments, and the position of the spiracle on joint 5 is not described.

Dr. Packard's remarks on page 91 agree with my own views, except that I regard this species as tending to become protectively colored, the bright warning color having partly disappeared. Hence the habits of concealment exhibited by the larvæ.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

My description of these stages of the Florida form will suffice for the New York ones. At first all are alike, though the mature larva is

so various. There is usually no permanent color till stage IV and after that the differently colored larvæ gradually differentiate themselves. I have followed out the full life history of the Long Island form in two instances, but do not find enough to warrant redescribing the stages in full.

Food-plants.—Oak, chestnut, bayberry, *Andromeda*, beech, sour gum (*Nyssa*) and wild cherry.

EXPLANATION OF PLATE III.

Fig. 1. *Euclea delphinii*, natural size.
" 2. Form *querceti.*
" 3. Form *interjecta.*
" 4. Form *viridiclava.*
" 5. Form *elliotii.*
" 6. Larva from Dutchess Co., form C.
" 7. The same, form E.
" 8. The same, form D.
" 9. Larva from Long Island, form A.
" 10. A short horn of subdorsal row × 45, with adjacent skin granules.
" 11. A detachable spine of the Florida larva × 175.
" 12. The same from a Long Island larva with one pair of patches.
" 13. The same from a larva with two pairs of patches.
" 14. A spine without the basal bulb; rare; × 175.
" 15. An unusually short spine; Florida larva.
" 16. A caltrope from among the detachable spines.
" 17. Caltropes in position on a lateral horn × 175.

Parasa chloris *Herrich-Schäffer.*

1854—*Neæra chloris* HERRICH-SCHAEFFER, Ausser. Schmett. fig. 176.
1864—*Limacodes viridus* REAKIRT, Proc. Ent. Soc. Phil. III, 251.
1881—*Farasa fraterna* GROTE, Papilio, I, 5.
1882—*Parasa fraterna* GROTE, Check List, 17.
1891—*Parasa chloris* DYAR, Trans. Am. Ent. Soc. XVIII, 154.
1891—*Parasa chloris* SMITH, List Lep. 28.
1894—*Parasa chloris* NEUMOEGEN & DYAR, Journ. N. Y. Ent. Soc. II, 72.

LARVA.

1864—REAKIRT, Proc. Ent. Soc. Phil. III, 251.
1887—HY. EDWARDS, Ent. Amer. III, 169.
1891—DYAR, Trans. Am. Ent. Soc. XVIII, 154.
1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 91.
1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 217.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space broad, of nearly even width, except at the extremities, where it narrows considerably. The dorsum rises abruptly to a maxi-

mum at joint 5 and then slopes to the tail, the slope becoming steeper after joint 11. Lateral space broad, nearly perpendicular and continuous in direction with the broad, not retracted subventral space. Subdorsal ridge well indicated by the abrupt change in direction between back and sides; lateral ridge slight; subventral edge prominent, two setæ on each segment. Horns at first as well developed as usual in the group (larvæ of type 2), but soon reduced, finally to small rounded spinose buttons. The subdorsal horns of joints 3, 4, 5, 8, 11 and 12 remain longer than the rest; that on joint 13 becomes early consolidated with its fellow into a tail directed posteriorly, at first cleft and spiny, later more uniform. The lateral horns are all small, subequal, situated on joints 3, 4, 6 to 12 as usual. The head is concealed under joint 2, but this joint is scarcely retracted, its spiracle remaining exposed by a lateral retraction of joint 3. The spiracle on joint 5 is moved up out of line with the rest, all being plainly visible, as the whole subventral region is freely exposed.

After stage I, the spines on the horns are of the stinging type, but they are gradually reduced in size and number and become functionless. In the last stage they are so much aborted that they are imperfectly erected after the molt and the group remains pointing inward over the back in the case of the larger horns. The small, black, piercing caps remain and the spines do not become setiferous, except in the case of some of the smallest anterior horns.

Depressed spaces feebly developed, represented by black spots; (1) round, distinct, paired; (2) and (3) tiny dots, segmental; (4) distinct, narrowly elongated and slightly oblique, in the middle of the lateral space; (7) slightly elongated, alternating with the spiracles; (8) a tiny dot above the subventral edge.

Skin covered with very small, dark, pointed spines, which become round, clear granules just above the subventral edge only. Small patches of caltropes are present on the upper side of the reduced lateral horns on joints 6 to 12. No detachable spines.

AFFINITIES, HABITS, ETC.

This larva seems to represent a recent offshoot of the main stem of the spined Eucleids. In its first stages it is very closely allied to *Euclea*, but finally the colors and armor degenerate and the shape is altered to one adapted for concealment. This direction of modification is indicated in both *Euclea delphinii* and *Adoneta spinuloides*, but here it is fully carried out. The tail, which is so like that of *[illegible]* and *Euli-*

macodes, is homologous with neither, as it is composed of the two subdorsal tubercles of joint 13 united, and not of a simple prolongation of the body. While the larva departs so widely from the primitive form of the spined Eucleids, the moth is generalized. I take the green thorax and band on the fore wings to be the primitive pattern of maculation, as it appears almost identically in both this species, and *Euclea indetermina*, whose larva are so different, and reappears in many South American and Indian species. *P. chloris*, then, is a form belonging to the most typical group of spined Eucleids, the moth unmodified, but the larva recently specially adapted.

The larvæ are found on the lower branches of trees, not on low bushes or brush. A rather low overhanging limb in a well shaded place is a favorite location. The eggs are laid singly, but often several on the same leaf and not infrequently of two or more ages, as different moths tend to select the same branch for oviposition. The eggs are laid from the middle to the end of July; the larvæ become mature at the end of August and during the most of September. They rest on the undersides of the leaves, feeding singly.

Eggs of this species occurred to me rather numerously at Bellport, Long Island, and this life history was worked out from them. The eggs are not as difficult to detect as usual on account of their proportionate large size.

CRITICISM OF PREVIOUS DESCRIPTIONS.

The published descriptions refer only to the mature larvæ, and are not as full as could be desired. Both Edwards and Packard speak of the subdorsal horns as "retractile tubercles." I think this term misleading. The horns have the normal structure, though short and degenerate, and only appear to be retracted by the movements of the flexible skin. Dr. Packard figures the spines and skin spinules (compare Plate IV, figs. 12, 13 and 14) with rather small magnification; but no one else has even attempted to treat of the finer structure, and the early stages have been altogether neglected.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—(Plate IV, fig. 8.) Elliptical, flat, transparent and very shining; 1.6 × 1.2 mm. Reticulations angular, linear, irregular, distinct. The leaf is perfectly visible through the eggs, which resemble spots of moisture or some clear gummy substance.

Stage I.—(Plate IV, figs. 1 and 2.) Elliptical, dorsum broadest centrally, narrowed at the large horns; sides perpendicular. Horns

arranged exactly as in Euclea, from which the larva is indistinguishable. Color all opaquish white, no marks. Length 1.2 mm. The larva does not feed in this stage.

Stage II.—Horns rounded, large, the subdorsals on joints 3, 4, 5, 8, 11 and 12 with many black-tipped spines, those on joints 6, 7, 9 and 10, with one or two spines. Lateral horns moderate, rounded, spined. Color all ground glass white. Skin finely granular; segmental incisures cleft-like; depressed spaces not indicated. Body widest at joint 5, narrowing a little toward the ends. Subdorsal horns on joint 13 small, approximate, projecting posteriorly to form a subquadrate tail. Later a chocolate brown shade appears dorsally on joints 3 and 4, the highest part of the body, which slopes backward from this point. Toward the end of the stage the full markings of the next stage may be assumed. Length 1.2 to 2.1 mm.

Stage III.—Elongate, the sides parallel, joints 3 and 4 a little the highest; subdorsal horns elongate rounded, those on joints 3, 4, 11 and 12 large, 8 moderate, the rest with but one or two spines; lateral horns very small with five or six spines, those on joints 3 and 4 the largest. Color honey yellow, a white line along subdorsal ridge, the pair connected by a narrow angular bridge on joints 5 and 11; dorsum on joints 3, 5 and 11 chocolate brown; a brown line along the lateral horns. Depressed spaces (1) and (2) indicated, faint, also the large lateral ones (4). Skin nearly smooth, finely remotely granular or punctate. The tail horns are partly fused into a short, cleft, spiny process; spines black tipped; head pale brown, eye black. Length of larva 2.1 to 3 mm.

Stage IV.—As before, the dorsum rather broad. Long horns large, rounded, whitish, with brown tips, short spined, the one on joints 8 and 13 white. Short subdorsal horns and the lateral ones of joints 6 to 12 small, inconspicuous, concolorous; a short notched tail. Body all brown, except a space in the dorsum on joints 6 to 10, which is greenish; a narrow white subdorsal line with white bridges as before, but on joints 5, 11 and 12; a white line along the subventral edge; a faint darker line along the lateral horns. Largest depressed spaces moderate; skin as before. Length, 2.9 to 4.5 mm.

Stage V.—Dorsum of joints 3, 5, 11 and 13, lower half of sides and tips of subdorsal horns on joints 3 to 5 dark brown; the rest of the body fleshy brown; dorsal vessel greenish; a fleshy pink tint along the subdorsal ridge with a narrow bridge on joints 5, 11 and 12; a pink line along subventral edge. Bases of subdorsal horns on joints 3 to 5, all of horns 8, 11 and 12 and the short, approximate tail-like pair fleshy pink;

other horns obscure. A broken, double, waved, pale addorsal line. Depressed spaces very obscure. Skin sparsely, very finely granular. Horns moderate, with slender, black-tipped spines. The anterior end of the larva is darkly colored, joint 11 conspicuously pale. Length 4.4 to 6.2 mm.

Stage VI.—Horns rounded, small, the subdorsals on joints 11 to 13 pinkish white, the rest brown, concolorous; proportions as before, tail cleft. Body dark-brown dorsally, and on the upper half of the sides, marked with paler as before; the lines on the ridge and the bridges rather faint. Central dorsal and waved addorsal faint, broken white lines. Horns all spined, but the spines on joints 4 and 5 point inward, not erected. Length 5.9 to 8.5 mm.

Stage VII.—(Plate IV, fig. 9, ventral view). Fleshy brown; dorsal and waved addorsal broken, segmentary, salmon marks; thorax and subventral edge shaded darker; subdorsal horns of 11 light. Horns short, rounded; tail slightly cleft, spiny. Dorsal paired dark dots (1) joined by a whitish band; (4) oval, dark, narrow holes low down on the sides. A narrow salmon line along the subdorsal ridge edged with dark above; sides with four salmon lines; a conspicuous pinkish line along subventral edge, bordered above by crimson and brown. Horns all dark except the subdorsals on joints 11 to 13; the long ones form rather large buttons. The shape is like the mature larva. Length 7.5 to 13 mm.

Stage VIII.—Tail pointed, spinose sometimes still cleft. Caltropes present (Plate IV, figs. 13 and 16) on the lateral horns of joints 6 to 12 in a large patch, the caltropes themselves with larger side spines than usual. Skin finely, rather densely spinulated (Plate IV, figs. 10, 13 and 14), much as in *Sibine stimulea*. Color without dark shades, the ground a sordid greenish marked with the numerous waved salmon-colored lines (Plate IV, figs. 3, 4 and 5), brighter posteriorly. There are five in the dorsal space, five in the lateral space, all somewhat confused. A narrow blackish line on subdorsal ridge, none on the lateral one. Subventral edge broadly pink, edged above by a dark red line. Depressed spaces (1) small, paired; (4) narrow elongate; (7), round, pit-like; (8) indicated, all blackish—no others. Horns short, the large ones with the spines turned in (Plate IV, fig. 11) dark, those on joints 11 and 12 whitish, contrasting. Shape as described above. In some examples the posterior portion of dorsal space is of a very bright, fiery color. Length 10.6 to 20.3 mm.

Food-plants.—Oak, chestnut, wild cherry, hickory and bayberry.

EXPLANATION OF PLATE IV.

Fig. 1. Larva stage I, side view.
" 2. The same, front view,
" 3. Mature larva, enlarged, side view, feeding.
" 4. The same, front view.
" 5. The same, back view.
" 6. Feeding traces of stage II.
" 7. The same of stage III.
" 8. Egg.
" 9. Ventral view of larva, the body shrunken preceding a molt, enlarged.
" 10. Skin granules at subventral edge, grading into the general spines above.
" 11. One of the large horns of subdorsal row, the spines imperfectly erected × 50.
" 12. Tip of spine, more enlarged.
" 13. Horn of lateral row, showing caltrope patch and skin spines.
" 14. Skin spines of same region, more enlarged.
" 15. Spines from a different region.
" 16. Caltropes. × 225.
" 17. *Parasa chloris*, natural size.

NOTE ON MR. GROTE'S REMARKS ON THE SATURNIANS.

BY HARRISON G. DYAR.

Mr. Grote's reply to my criticism on his paper "Die Saturniiden" is disappointing. I had hoped that he would adopt my suggestion to take three or four entirely different characters, work each out independently in the same manner as he has done for vein IV² of primaries and let the evidence from these show whether his classification or mine was the nearest the natural one. Instead Mr. Grote defends his classification on the original grounds and misstates (unintentionally of course) and belittles the larval characters. The matter is certainly simplified by "setting down the loss of the pair of anal tubercles solely to the Citheroniinæ." The only objection that I know to this ingenious solution is that it is not a statement of fact. But, seriously, it remains that the genealogical tree deduced by Mr. Grote is contradictory to the one that I have made on larval characters. My original statements are not affected, so far as I can see, by Mr. Grote's insistance on the importance of his characters; it is open to me to insist equally on the importance of mine. Collateral evidence only can decide the question, and this Mr. Grote has not adduced. In reply to Mr. Grote's kind wish to convert me to his views, I again point out the path to that end, or at least the path which must lead to the end of a mutual agreement, whether on Mr. Grote's system or mine, or some other more natural one, which we neither have thought of.

THE PROTECTIVE VALUE OF ACTION, VOLITIONAL OR OTHERWISE, IN "PROTECTIVE MIMICRY."*

BY F. M. WEBSTER.

Whatever in the form, color or actions of an organism tends to enable it to escape from its enemies, or more readily secure a proper supply of food, is, to a certain extent, protective in its effects. Forms, not in possession of such advantages, will, in case of an unusual abundance of enemies, or a deficit in the supply of food, be the least likely to survive. In this paper it is the intention of the author to discuss only such cases of "protective mimicry" as require some special movements, or the assumption of some peculiar or unique position, on the part of the protected form, in order to continue or complete the deceptive effects of its shape, color or coloration.

There are a number of insects that, prepared and placed in our cabinets, have comparatively little resemblance to each other, while in the midst of life and activity, are distinguishable from each other only with extreme difficulty. An example may be found in *Podosesia syringæ* Harr., which somewhat resembles *Polistes annularis* Fabr., in form, while its movements are almost an exact reproduction of those of the latter species, which is an armed wasp, while the former is a helpless moth. The Varying Hare, *Lepus americanus virginianus* Harlan, no doubt derives more or less protection from the color of its fur, but this protection does not appear to be supplemented by any correlative action on the part of the animal itself.

Many naturalists object to the use of the term "protective mimicry," for the reason that it implies mental capabilities supposed to be confined to the human race. The statement is made, and by those whose opinion is worthy of the greatest respect and most careful consideration, that the influences of natural selection are amply sufficient to account for all such phenomena, and that we do not need to assume the presence of volition as a factor in such phenomena. In some quarters the initial step, in an investigation of the phenomenon of "protective mimicry," is to close the door, so to speak, against any possibility of the most primitive kind of intelligence, on the part of the mimicing species, while to admit that a mimicing insect has any conception of its own appearance, is the most dangerous sort of heresy. Now there are

* Read before the Ohio State Academy of Science, December 30, 1896.

quite a large number of zoölogists who both work and think, who do not believe that natural selection is adequate to explain all of the phenomena that come to the notice of the naturalist, and as a leader of those who hold this view, we have that venerable thinker, Herbert Spencer. It is clear enough that natural selection will maintain or even perfect what has already been begun, but that it can set the machinery of protective mimicry in motion—can bring a case of protective mimicry or coloration into existence, seems extremely doubtful. In the first place, we must remember that "self-preservation is the first law of nature," even in man. No human being will voluntarily take his or her own life unless mentally deranged, or as a sacrifice to some great and important principle, or to save the lives of others. Old and battle-tried soldiers, whose acts of bravery have become known from one side of the world to the other, have acknowledged that the impulse to break and run, when first going into battle, had each time to be overcome. If self-preservation is the first law of nature, then fear and the sense of pain are the police powers, so to speak, that enforce the law. The soldier who drops his gun and runs away, instead of facing the enemy, has allowed the fear of pain or death to overcome his sense of duty and he seeks a place of greater safety; seeks to preserve his life. Among all animal life below man, we find a different condition to exist, in that the whole aim and object of life is to reproduce. The same phenomena may be observed, even among plants, the whole of the remaining vitality of an injured tree or a girdled vine, being exhausted in producing a few seeds or seed inclosing fruit. In fact, almost a parallel may be observed to some extent among consumptive men and women. Among lower animal life, unless the young require the protecting care of the parents, as soon as this duty of reproduction is accomplished death, generally speaking, occurs, although among insects the period of reproduction may vary from a few hours to several years, according to species. Protection, in the egg stage, is usually accomplished, where such is needed, by the mother insect in her selection of a place of oviposition, but both herself and the larvæ may need protection from natural enemies, and such protection may result from a close resemblance to other protected species, or to inanimate objects, thus deceiving, to a greater or less extent, the natural enemies that threaten their destruction. It often occurs that the form and color of the adult or of the larva is such as to afford protection, but there are many cases, where, without the assuming of certain positions, to represent forms not preyed upon, or inanimate objects, like twigs, lichens or portions of flowers, or where peculiar movements are

necessary to complete the deception, form and color would fall far short of protecting. The point in dispute is as to whether these actions are of volition, and with the anticipation of protection to be derived therefrom, or are they involuntarily, and to be classed with the blushing of a timid maiden when becoming suddenly confused, or the whitening of the face of the less timid, when brought suddenly face to face with what appears certain death? The timid maiden is in no danger, and blushes not because she intended or wished to, but because she had no power to avoid so doing; while the frightened one was in danger, but equally unable to prevent a different change of color in her face, though no protection would result. If, as we suppose, the sense of pain decreases, as we descend in the scale of animal life, than the action that, with form and coloration, tend to deceive the enemy, must be made in order to escape destruction. A recent writer in Natural Science (Vol. IX, p. 299) states that while sitting in a tree, rifle in hand, waiting for a tiger, his attention was caught by a kind of slow cricket, which exactly resembled a small patch of gray lichen, skurrying round the trunk of a neighboring tree, with a lizard in full pursuit. "Just as the lizard came up with it, the cricket, falling in with a slight depression in the bark, stopped dead and flattened itself out, and the lizard was utterly confounded. There it stood, looking ludicrously puzzled at the mysterious disappearance of its prey, which was just under its nose." Here we have a sense of danger, a fear of death, and an attempt to escape death by flight; and when still pursued, certain actions that rendered the peculiar coloration of the insect of greater life-saving value than flight, were employed. With no knowledge of its own resemblance to a patch of lichens, and equally ignorant of the protective value of this resemblance, would the insect not have continued to attempt escape by further flight? How did it know that the pursuer was an enemy? How did it become aware that, to receive the benefit of its appearance, it must stop, when it had before followed the opposite course? If it had no knowledge of its appearance, how would it be able to separate one of the opposite sex from a patch of lichen? Without such a knowledge how can there be sexual selection at all?

Under the head of "A Case of Mimicry," Prof. Otto Lugger, in Entomological News, Vol. VI, pp. 138-140, gives a quite similar case of protective mimicry, as observed by him in *Marmopteryx gibbicostata* Walk. Professor Lugger saw on an elm tree what appeared to be the remains of a moth that had apparently been left over from the dinner of a spider, and, recognizing it as new to his collection, like every

other entomologist, preferring a poor specimen to none, attempted to secure it, when he was astonished to see his treasure take wing and disappear. Returning again to the same tree an hour later, he observed a second specimen, or perhaps the same one in the same position, but this took wing and disappeared. Returning again next day, he began to brush the trunk of the tree with a small limb, as is usually done in flushing *Catocala*. Finally, a moth alighted within two feet of him, ran rapidly a few inches and disappeared. It was then that the observer saw that the moth, after reaching the tree, would run to some projecting piece of bark that had a certain gray color so common upon old elm trees, then make a quarter turn, and fold its wings in a peculiar way upon the spot selected, that blended so well with it as to become invisible. In the normal position of these moths when at rest the color of the upper surface of the wings would contract with the color of the surface on which it was resting; as only the color and markings of the under side of the lower wing, and a narrow margin of the upper edge of the under side of upper wing, harmonize with the grayish spots before mentioned, and therefore these last must be displayed and the others hidden. The moth by making a quarter turn, and by pushing the upper wings deeply between the lower ones, effectually hides all colors not in harmony with its surroundings. As the colors upon the exposed parts vary somewhat from a very pale to dark, the insect, in order to render the deception complete, must select a spot of the proper shade to correspond; yet Prof. Lugger states that of the hundreds of moths he saw, none could be detected upon the trees unless the spot upon which they were observed to settle was kept carefully in sight until they were approached closely. In this case the deception was more largely a matter of action than of coloration, and the action would certainly imply a knowledge of not only the colors of its own wings but of its surroundings also. Collectors of *Catocala* are familiar with similar phenomena among that group of moths, as a scar or slight blaze, such as is often made by woodmen to mark paths or boundaries, are more often selected for resting places than other parts of the trees.

In North American Entomologist, Vol. I, p. 30, Dr. D. S. Kellicott has called attention to the fact that the moth *Alaria florida* Guen., conceals itself during the day in the withering blossoms of the Evening Primrose, *Œnothera biennis*. The inner two-thirds of the fore wings of this moth are bright pink, while the outer third, hind wings and abdomen, are pale yellow. The moth enters the flower before day,

with its body resting upon the style, the four-parted stigma projecting beyond the tip of the abdomen, appearing like a part thereof, and when the sun appears the two petals that were above the moth soon wilt and fall down over the roof-like wings, concealing the hinder portion, leaving the yellow part exposed as a part of the blossom, and so effectually is the moth concealed in this way during the day, that only a trained eye can detect its presence, and even then with extreme difficulty.

Some time after Dr. Kellicott had published his observations, and before I knew of them, I find, from looking over some old note books where I had recorded observations made in Illinois, that a specimen of this moth was taken by myself under much the same circumstances, except in this case the pink color was exposed from under a reddening, discolored leaf of Evening Primrose, in such a manner that the *yellow* was concealed and the deception was so marked that I made a record of it at the time. I still have the moth in my possession, and I have never taken a specimen except on this plant, and concealed in the manner indicated by the observations of Dr. Kellicott and myself.

In "A Naturalist in the Transvaal," pp. 41, 42, Mr. W. L. Distant calls attention to the fact that while a butterfly, *Hamanumida dædalus*, in Senegambia, Calabar and the Cameroons, according to report, always settles with the wings vertically closed, and which so closely resemble the soil of the district, that it can with difficulty be seen, the color varies with the soil in different localities, yet in the Transvaal, and Natal, he was never able to observe it to rest except with horizontally-expanded wings, by which its protection was almost equally insured, by the assimulative color of the same to the rocks and paths on which it was usually found. Here we have an insect breaking away, or at any rate differing radically from a prevailing habit, where such habit would tend to expose it to natural enemies, and following that habit where it derives protection therefrom.*

In the case of *Podosesia syringæ*, which when in flight the abdomen has almost the exact position of *Polistes annularis*, when it is at rest, the posterior segments are bent downward and kept in motion, and if

* While quite foreign to this particular point, it is interesting to note the difference in the action of our domestic sheep, in different parts of the country, on the appearance of sudden danger, like a wolf or dog. In the eastern and central-western states, a flock will break and run for a place of safety, and if still followed will scatter, each individual for itself. But in the far West, on the appearance of a like danger, the sheep will run directly to a common centre, and arranging themselves in a circle, heads outward, await further movements of the enemy.

it falls to the ground it will walk about precisely like the wasp it seems to resemble the most closely, so that its actions constitute by far the greater portion of the mimicry, and therefore are to the greatest extent protective in effects.

Among those species which resemble ants the most closely, and appear to derive protection therefrom, we find that, besides a more or less close resemblance in form and color, they have the erratic, rapid movements of such species of ants as they most resemble. *Pilophorus bifasciatus* Fab., a species of Hemiptera which is here in Ohio frequently associated with a species of black ant that is common and very often observed running up and down the trunks of trees and out on the limbs and twigs, does not closely resemble one of these ants when pinned and placed in the cabinet of a collector; but when running about over the trees they have the quick, erratic movements of the ants, and are then very difficult to distinguish from their associates.* In this case the deception is largely due to movement, and but for this there would be little resemblance. Belt, in "The Naturalist in Nicaragua," p. 314, speaks of a species of spider that appeared so exactly like a species of stinging ant that he did not distinguish the difference until he had killed the spider, and adds that "the resemblance is greatly increased by the spider holding up its two fore legs, like antennæ, and moving them about just like an ant."

Not over a couple of hundred yards from where I am now standing I was some years ago collecting small insects from the leaves of an elm tree, and saw what at a glance I took to be the excreta of a bird on the upper surface of a leaf, and, avoiding it, was busily engaged with my collecting. On making a sudden thrust I brought my hand in direct contact with the leaf, and not perceiving any excreta on my hand looked for an explanation, when, to my utter astonishment, the larger portion of the supposed excreta was observed to take legs and run across the leaf, and I found that it was nothing more or less than a small spider, whose back was clouded with a blackish area, surrounded with white. A white splotch remaining on the leaf proved to be only an irregular sheet of spider web, but almost exactly counterfeiting the appearance of semi-liquid bird excreta that had become dried, and I saw at once through the whole deception. Taken separately, the spider was easily recognized, but placed on its sheet of thin white web and the deception was

* In this case the rays of light reflected from the polished, black surface of the abdomen of the ant, appear like a transverse whitish band, very like in appearance to the transverse white fascia on the wings of the bug.

complete, and I have no doubt but that it not only escaped its enemies, but secured a better supply of food in consequence of its concealment, though in plain light, in a most exposed position. Mr. Henry O. Forbes, in his "A Naturalist's Wanderings in the Eastern Archipelago," p. 63, gives a similar experience of his in Java. In this case the observer saw what he supposed to be a butterfly at rest on a splotch of bird excreta on a leaf. Mr. Forbes carefully approached his prize until he was able to seize it between his fingers, when, to his astonishment, the wings parted from the body, which was left behind, and he still thought it had adhered to a small splotch of bird excreta until he touched the latter with his finger to find if it was glutinous, when, to his delighted astonishment, he found that the supposed excreta was really a peculiarly colored spider lying on its back, with its feet crossed, and on an irregularly shaped film of web, appearing like a splotch of excreta, with its central and denser portion of a pure chalk-like color, streaked here and there with black, the white margin being drawn out into a narrow streak, with a slight thickening at termination near the margin of the leaf. Two years after, in Sumatra, Mr. Forbes, while waiting for his servants to procure some botanical specimens for him, rather dreamily plucked what appeared to be an excreta-marked leaf, and, while looking at it, mentally wondered why it was that he had never found a second specimen of the curious spider found in Java, when suddenly the supposed excreta bit him, and he was astounded to learn that he actually had a second specimen in his hand (loc. cit., p. 216).

In transmitting his specimens to Rev. O. P. Cambridge, for determination, Mr. Forbes used this expression: "the similitude is so exact that the spider might have had consciousness, and it could not have been more exact if the spider did have it," referring, of course, to the placing of itself on its sheet of web and the deceptive resemblance previously mentioned, though he really had no intention of crediting the spider with any conscious design, as Rev. O. P. Cambridge at first supposed. The latter gentleman, however, offered the following explanation of the phenomenon (loc. cit., pp. 119–121): "It seems to me, on the contrary, that the whole is easily explained by the operation of natural selection, without supposing consciousness in the spider in any part of the process. The web on the surface of the leaf is evidently, so far as the spider has any design or consciousness in the matter, spun simply to secure itself in the proper position to await and seize its prey. The silk, which by its fineness, whiteness and close adhesion to the leaf causes it to resemble the more fluid parts of the excreta, would gradually attain

those qualities by natural selection, just as the spider itself would gradually, and probably *pari passu*, become, under the influence of the same law, and more and more like the solid portion." And further, in a foot note on p. 121: "Is not this exactness probably the result of the unconsciousness of the spider? Conscious-design would possibly have resulted in a failure and abandoning the plan, or at least in a more clumsy imitation." *

To a great many naturalists it would appear as though if consciousness were present at all it would first exhibit itself in protecting life and afterwards in sustaining it. Without life food would be unnecessary, and the same consciousness that would lead the spider to take certain precautions to sustain life would impel it to take other or, perhaps, the same precautions to protect its life. The earlier attempts might be crude, but so long as they obscured the spider from the equally crude vision of either foe or victim, it would suffice. Of course, if it should be found that these species of spiders are inedible, then the whole effect of the deception would be to aid in sustaining life, but this is yet to be shown. Besides, it does not appear impossible that a kind of obscure and limited consciousness may have developed, springing, perhaps, from inherited instincts sufficient to enable these spiders and various species of insects to take advantage of action or movements, in order to protect their lives and perpetuate their species, but not extending beyond this point in development.

When, in the earliest development of animal life on the globe, one form or individual began to prey upon another, then self-preservation became necessary, and death a catastrophe to be feared and avoided. We would, here, have the first fear-incited efforts put forth to escape destruction by flight—the first impulse that seizes even man at the present day, when suddenly exposed to impending danger. The next effort, usually put forth by an organism, is to hide or secrete itself from a danger that, perhaps, cannot be avoided by flight. The second of these efforts, it is possible, might have followed the first very rapidly in time of development, and, later on, as the struggle for life became more severe between different forms, concealment for the purpose of surprising and capturing prey might have developed, and still later, the attempt at defense on the part of the form pursued, would lead to trials of strength between the attacking organism and the organism attacked,

*These isolated observations give us no data whereby to judge to what extent individual spiders vary from each other in their architecture, or to what extent, if any, the young profits by imitating its parents.

but the object of all of these efforts would be the protection of life, by escaping capture and securing food to sustain that life, and the most successful would be the most apt to survive.

But have we not had, during all of this time, a consciousness of possible destruction and volition in the efforts put forth to get out of the way of an enemy in pursuit? Do not these, in fact, coexist with animation itself; and does not their presence really afford natural selection the primary foundation with which to begin the development of certain characteristics, and perfect such to an extent necessary to the life of an organism?

Another kind of phenomena, commonly termed feigning death, also comes within the scope of this paper, and includes such species as, when they are alarmed, either fall to the ground or assume certain rigid positions while attached to plants, or both, so as to appear either dead or like some lifeless object. Many insects, when disturbed, will draw up their legs and falling down remain perfectly still and rigid until the supposed enemy has passed on. Very many of our beetles do this, and because of our common opossum *Didelphys virginiana*, taking a similar course in its attempts to escape death, the action has been vulgarly termed "playing possum." Species belonging to the Coleopterous genera *Chlamys* and *Exema*, however, are shaped and colored so as to almost exactly represent the excreta of caterpillars, and when feeding, if disturbed, will drop to the ground if not caught by the leaves of the plant upon which they are feeding, and as they lay perfectly still, may be unrecognized by even fairly good entomologists. But, even the peculiar form and color of these insects would fall far short of protecting them while feeding, as their position at that time is so entirely different from that under which the excreta of caterpillars is usually observed; but, when they loose their hold, and drop to the upper surface of a lower leaf and either remain there or roll off and fall upon the ground, the deception is complete.

The resemblance of the larvæ of Geometridæ, to small twigs of trees and shrubs is everywhere observed, and as universally excites feelings of delight and surprise. When disturbed, the caterpillars assume a rigid position, more or less transverse to the limb upon which they are located, so that their position, together with the peculiar form and color of their bodies, render them not easily detected. In some species, the form of the body is such as to closely resemble a dead twig, even to the buds thereon. In this case it requires the assumption of the peculiar and rigid position, in order to complete the deception so far as it is

complete. On one occasion I found several eggs of a parasitic fly, one of the Tachinæ, placed among the bases of the legs, where the enemy could by no possibility have placed them had the caterpillar not occupied the peculiar position that it assumes when disturbed, thus showing that the deception was not complete.

An interesting point is here brought out, as, if all individuals attacked died, there would be no progeny and, therefore, no transmission of acquired life preserving consciousness, this could only be brought about by individuals that were attacked and escaped death. A new enemy would be more crude and bungling in its work, and thus allow of a greater number of escapes.

Now, in all of these phenomena we have form and color, supplemented by action, the object of all of which, taken together, is the protection of life. Indeed, what else have these organisms to protect? And of what service would life be to an organism, without intelligence enough, to, in a measure, enable the possessor thereof to protect that life? In all of these actions and movements, do we not have the same kind of consciousness, intelligence and volition, that we do in the case of a bird building a nest, with the expectations of laying its eggs in that nest and rearing its young? Are not all of these positions assumed, and movements made, with the sole aim of protecting life—continuing to live? Did not life and a life protecting intelligence co-exist, in the beginning, in some primitive organism, and was not this primitive, live-protecting intelligence, developed side by side with form and color, until the present conditions of affairs has been the result? The term "protective mimicry," is misapplied when used to designate this developed condition, because that term implies the personation of different objects, by different individuals of the same species, at the same time and in the same exact locality, which is not the case. But, though the same species may "mimic" different species in different localities, or different sexes may "mimic" different species, or one sex "mimic" and another not, yet these conditions cannot be changed to meet any sudden change of environment. Not only will the forms, colors and colorations continue long after the enemy to be protected from has disappeared, but as Mr. Distant has shown ("A Naturalist in the Transvaal," p. 66,) the "mimicing" form may continue to "mimic," even when the mimiced form has fallen far below it in point of numbers and becomes almost or even quite extinct.

It was Mr. Bates who wrote in his "The Naturalist on the Amazon," that "on the wing of the butterfly is written, as on a tablet, the story

of the modification of the species, so truly do all changes register themselves thereon," and it seems to me that in the brains of so-called "mimicing" species of insects, we might, if we could but understand the full significance of brain cells, read therein the records of the development of a dim, obscure consciousness, a volition and an intelligence that has kept pace with the requirements of these organisms, in protecting their lives and perpetuating their race. Man himself comes into the world, little less than a mere automaton, but with an inherited basis for future development of an individual consciousness. He begins his education with the alphabet, but does not transmit even a knowledge of this alphabet to his offspring, who must begin precisely where he himself began. But there has descended to his children, that which will enable them to master the alphabet with more aptitude and less difficulty. Now, if we descend the line of animal life, until we reach these insects whose movements go far toward perfecting the protection afforded by their form, color and coloration, may we not expect to find the foundation for a "species consciousness" that will enable the possessors to protect their lives from enemies of long standing and gradually, though, perhaps very slowly, adapt themselves to shunning the attacks of more recent foes? Or, to put the question in other words, with a protective appearance, will there not go either a consciousness of that appearance, or an inherited foundation for such a consciousness, that will the better enable an insect to apply its protective inheritance, and in the use of all of these, as a means of perpetuating its kind, follow strictly in the line of all other animal life?

NOTES ON THE TRANSFORMATIONS OF THE HIGHER HYMENOPTERA. II.

By A. S. Packard.

Polistes (probably **P. canadensis** *Linn.*).

Larva.—It differs generically from *Vespa* in its head being about twice as large; the body is much shorter, a third shorter than in Vespa, and more ovoid; the end sharper, the body narrowing rapidly towards the tip, which is more pointed than usual; towards the head it tapers rapidly, the prothoracic segment being small in proportion to the head. The lateral ridge of the body is but slightly prominent. The body is not entirely cylindrical, but very convex above, and flattened beneath. The last sternite is twice as broad as long; the sides of the anal opening

are more exserted and prominent, the last tergite being much more produced than in Vespa. The nervous system is nearly the same in the middle of the body, but owing to the shorter segments the ganglia are nearer together, and each ganglion is opposite each suture; the size of the ganglia and of the cords are the same, but the ganglia appear to be a little farther separated than in *Vespa*, in the specimens examined.

The head is very large, round, short and broad, full, convex above. The eye-slits are long, narrow, oblique and prominent. The antennal tubercles are flat, depressed, large and conspicuous, and are placed on each side of the clypeus and in a line with the anterior or lower end of the eyes. The clypeus is large, very regularly equilaterally triangular, the apex or posterior portion separated by a slight suture from the anterior and much larger portion; the front edge is straight and aligned with the squarely docked front edge of the side of the head. Labrum very broad and short, nearly as broad as the clypeus is long; the front edge is straight, the sides well rounded; rounded, swollen, full and very prominent at the end. Mandibles broad, triangular, very acutely bidentate, much shorter and broader at base than in the Apidæ, very convex on the outer side. Maxillæ large, full, swollen, with two small corneous tubercles on the interior next the mouth. Very full and bulging externally. Labium well separated from the mentum by a distinct suture, with two terminal tubercles. Mentum broad, low, triangular, not quite reaching to the outer side of the maxillæ, but nearly as broad as the head.

It differs from the larva of *Vespa* in having the antennal tubercle a little more approximate, the clypeus more regularly triangular and more distinct, while the labrum is very much larger and excessively swollen. The mandibles are very different from those of *Vespa*, being bidentate, very acute, broad at base, triangular, while in *Vespa* they are tridentate, oblong, and as wide at the tip as at the base, the teeth being rather equal and blunt, while the mentum is not prominent. The entire head is freer from the body in *Polistes*, and harder, more corneous than in *Vespa*.

Both *Polistes* and *Vespa* larvæ differ from those of *Bombus* and Apidæ in general in having the clypeus and mouth-parts larger; by the antennal tubercles being more distinct, by the presence of the eye-slit, by the larger mandibles and maxillae, while the entire head is larger in proportion to the rest of the body, and the surface of the segments are smooth. The end of the body is more acute, and the lateral ridge less marked. (In the larva of *Pompilus*, the segments are more thickened

than in *Megachile.*) The sides of the epicranium at the insertion of the jaws in *Vespa* do not bulge out, and become squarely truncated as in *Polistes.*

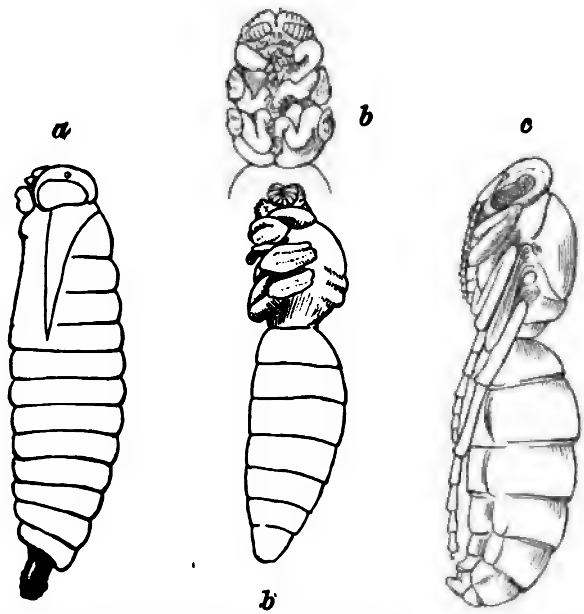

Fig. 6. *Polistes*, *a*, larva beginning to change to pupa; *b*, semipupa; *b'*, ventral view of head and thorax; *c*, pupa, $\times 3$, (Emerton *del.*)

Pupa.—Compared with that of *Vespa maculata* the body is much longer and slenderer and the tubercle on the head is not near so large and prominent. The clypeus is longer and fuller; the labrum is small. The antennæ have the joints half as long, and the appendage, as a whole, is still less bent than in *Vespa*, and much shorter than in *Vespa*, not reaching to the tip of the anterior legs. The trochanters are very much larger than in *Vespa* and at least twice as long. The maxillæ are much shorter than in *Vespa*, the lingua not so deeply bifid. The legs are much longer than in *Vespa* and the wings do not reach so near the tibial spurs as in *Vespa*, while the hind legs nearly reach to the tip of the abdomen. Seen sideways, the legs and wings, especially, are much more oblique and parallel to the longer axis of the body than in *Vespa*. The thorax and long narrow subpedicellate abdomen are much as in the imago. The ovipositor is still exserted, while the last tergite is greatly

expanded, forming an irregularly hexagonal expansion, the end of which is broad and square, with the edge excavated.

Vespa (probably **V. arenaria** *Fabr.*).

Larva.—The head is about as long as broad, the vertex very slightly depressed in the mesial line. Eyes well marked by a long narrow testaceous line. Antennæ rather remote from the sides of the clypeus, when compared with those of *Polistes;* the round flattened antennal area, situated within an ovate much larger area, is obsolete in *Polistes.* The clypeus is much longer and narrower than in *Polistes*, extending farther back towards the vertex; the posterior portion not being so clearly divided from the anterior part as in *Polistes.* It is a quarter longer than wide, and it differs very much from *Polistes* by its front edge contracting and narrowing towards the labrum, where in *Polistes* it rather spreads, so that the labrum is much narrower, being less swollen, nd shows a tendency to become bilobate. Mandibles stout, thick, oblong, bidentate, the teeth small, cylindrical, not nearly so sharp as usual. The maxillæ are 2-tuberculate, swollen externally. The labrum is distinct from the mentum, with two terminal tubercles, and a terminal testaceous line, probably the lingua.

The body is long, cylindrical, not curved on itself so much as in *Polistes* owing to its posture in the broad cell, which is longer and narrower than that of *Polistes.* Posteriorly each segment is somewhat thickened, as are the pleural ridges. The end of the abdomen is rather blank, the last sternite large and transverse, while the tergite is considerably smaller than in *Polistes.* The elements of the ovipositor are distinct, two rather remote tubercles visible on the 8th abdominal segment, and 4 arranged in a semicircle on the 9th, the two inner ones much larger than the minute outer pair. Above, owing to the thinness of the pellicle along the median line of the body, the dorsal vessel can be distinctly seen in the alcoholic specimens; each section of the vessel dilating probably near the posterior edge of each segment where the valves are probably situated and dilating not angularly so to speak from the insertion of the succeeding section.

Halictus parallelus *Say* and **H. ligatus** *Say.*

Larva.—Body very slender, cylindrical, quite different from the broad flattened body of *Andrena;* it is rather obtuse behind, but in front tapering slowly towards the head, which is of moderate size, and of the width of the prothoracic segment. The thoracic segments are a little tuberculated on each side; they are much more convex than the

abdominal segments which are nearly smooth and very round. The specimen described was not fully grown and was found by Mr. J. H. Emerton, August 13, with eggs of the second brood.

When the larva has voided all its excrement the tubercles over the whole body become very prominent, extending from low down on the side of the body, forming high, regular, very prominent transverse ridges, which beneath the abdomen are more prominent than on the inside of the thorax. Length, .40 inch.

In examining the larvæ of *H. parallelus* and *H. ligatus* the head only differs, so far as one can tell, by the sides of one species bulging out; in the mandibles of *H. ligatus* being longer and slenderer, and the notch below being longer and ending in a distinct seta. The head in the two species is of about the same size; the clypeus is of the same shape, the head above being a little more divided in *H. parallelus* than in *H. ligatus*. The entire larva of *H. ligatus* is much longer and slenderer than that of *H. parallelus*, and the thickened tuberculous portion of the segments inclined to be a little more prominent. These differences are sufficient to produce changes in form, rendering the identification of the larva easy, but the best specific characters are the differences in size and slenderness of form. The larvæ being just in the period approaching the semi-pupa stage, the head is protruded and the segments more or less elongated, as the parts of the pupa growing beneath press out the larval skin in various directions. The ovipositor can not be detected beneath the thin larval skin.

This larva (the following description applies to it when in the early semi-pupa stage, and there are no hairs yet developed) differs from that of *Andrena vicina* in being longer and slenderer in proportion. The antennae are shorter, stouter and more clavate. The mandibles in this stage are not corneous. The maxillæ are shorter, the lingua much longer than the tips of both pairs of palpi, which are of the same length as in *Andrena*. The two tubercles behind the ocelli are unusually prominent. Of the three ocelli, which are arranged at points in an equilateral triangle, afterwards becoming a very slight curved line, the middle one in front is not raised.

In front of the ocelli, arranged transversely in a slight curved line, are four low, flat tubercles which resemble the ocelli; these disappear when the pupa becomes mature. The head and front, including the clypeus and labrum, are as in *Andrena*, but the supra-clypeal region in the specimen before me is better marked. The legs are a very little slenderer, and the hind tarsi do not reach nearly to the tip, but only half way, as the abdomen is much less elongated than in *Andrena*.

The thorax is very convex, there are two high prominent tubercles on the scutellum, which are higher and longer than in *Andrena*, also two smaller ones on the meta-scutellum (none on the port-scutellum). The propodeum is more like an abdominal segment than a thoracic one; it is broad and square-cornered, twice as broad as long, not yet separated from the abdomen. The latter is now one-half larger than the head and thorax. The segments posteriorly are very convex, and the edges very distinctly, thickly and finely dentate; the end or terminal segment of the abdomen is long and slender.

The presence of the four deciduous semi-pupal tubercles on the head, which in this stage are so large and distinct, and which are arranged in a transverse line just in front of the ocelli, is interesting and deserves further investigation, as their use is unknown. The fact that all these tubercles disappear afterwards is of additional interest, also the circumstance that they do not exist at all in the corresponding stages of *Apis* and of *Bombus* is perhaps a characteristic of that sub-family of Apidæ (*Andrenetæ*) of which *Halictus* is a member.

The pair of tubercles on the meso-scutellum and meta-scutellum are also of corresponding interest. They are scarcely homologous in position with those of *Oxybelus*, except those on the meta-scutellum. The serrate, very convex abdominal segments are noteworthy, as being a "low" feature. Also noticeable are the great differences between the two high posterior tubercles on the sides of which are situated the two posterior ocelli, so different from the anterior sunken ocellus.

Andrena vicina *Smith.*

Larva.—In *Andrena vicina* the larva is not only much larger, stouter and thicker than that of *Halictus* (*H. parallelus and ligatus*), and not so long in proportion, but the thickened tuberculous portion of the segments is broader, and not so sharply ridged. The two tubercles on the head are more prominent. The clypeus is wider and squarer, and the entire clypeal region broader; the mandibles are stouter and blunter, as are the maxillæ; the best characters are the stouter, more truncate mandibles, and the more raised tubercles on the vertex.

Head with the vertex rather deeply impressed by the median line; on each side is a high, prominent, acute tubercle. The lateral region on each side of the depressed median portion bulging, convex. This median region is divided into two slightly convex pieces. The clypeus is divided into an anterior and a posterior portion. The labrum is nearly square, quite distinct from the clypeus; the edge is square, the sides narrowing very slightly towards the front edge. On each side of the front edge of

the clypeus is a dark, corneous, minute, stout, acute spine. (The use of this process is unknown; it is not present in the larva of Sphex, and is an interesting larval structure.) The mandibles are long, narrow, incurved, the tip very acute and rather long. The maxillæ are cylindrical, stout, short and thick, obtuse, ending in a corneous, black, low, obtuse tip. The labium is short, divided a little at the end, and in the middle into two short, obtuse tubercles.

Compared with the larva of *Bombus* the vertex is not so rounded and smooth, while the lateral eye-pieces are remote and more bulging in front, leaving a broad, depressed mesial interspace; the distinction so marked in Bombus between the clypeus and labrum is in *Andrena* almost annulled, the labrum in *Andrena* being at first easily mistaken for an anterior portion of the clypeus, until after comparison has been made; its edge differs from that of *Bombus* and most other hymenopterous larvæ in being square, entire and much longer, while the trophi, *i. e.*, the maxillæ and labium, are in *Andrena* a little shorter, less produced beyond the mandibles and labrum. In *Andrena* and *Halictus* the segments are much more convex and angular, more tuberculous, while the last abdominal segment is broader, more transverse than in *Bombus*, where it is orbicular.

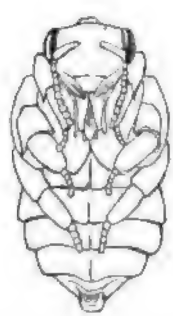

Fig. 7. *Andrena vicina*, pupa, enlarged nearly three times. (Emerton *del.*)

Nomada (probably **imbricata** *Smith*).

Larva.—The head is much smaller in proportion to the rest of the body than in *Andrena*, smoother and rounder, somewhat flattened, seen from in front somewhat square, with the angles rounded off; the eye-pieces not full convex as usual, but continuous with the middle of the front, which is not depressed mesially. Two black chitinous tubercles situated rather far apart on each side of the epicranium in a line with the insertion of the mandibles, being much farther apart than the sides

of the clypeus, which is short and narrow, projecting from the epicranium and shorter than the labrum. The latter is squarish, convex and rounded at the end, which is thickened, with the edge entire, and provided with four chitinous acute tubercles, two on the edge and two behind. There is a deep depression or pit between the labrum and the insertion of the mandibles. The latter are short, very stout, thick, conical, suddenly ending in an acute mucronate point or spine; they are short, situated far apart, and in my alcoholic specimen do not meet, only reaching to the sides of the labrum. Maxillæ unusually short, low, obtuse, thick, terminating in two very minute corneous, low, obtuse tubercles. Labium stout, short, thick, obtuse. Body long and slender, the segments very regularly convex, scarcely thickened, more so in the middle of the body than in the prothoracic segment, where it is most marked in *Andrena*; the lateral region distinct, the smaller portions less marked than in the higher genera, an important distinction, especially observable in the lower genera of fossorial Hymenoptera, such as *Sphex*, where there is scarcely any difference in shape between the prothoracic and the abdominal segments. Beneath, the segments are smooth, regularly convex, not thickened. The body is straightened out more than usual, tapers unusually fast towards the end of the abdomen. The last segment is much more rounded, more prominent or exserted, more convex, and free from the rest of the body than usual, even in *Sphex*.

On a part of the head, and on the sides, and vertex, and on the tergum are blackish pigment cells; the thickened tergal portion not ending in spinules as usual. The spiracles are large and more distinct than usual in non-parasitic Apid larvæ.

In all respects the larva of this parasitic genus is lower, more degraded, much less differentiated than in the non-parasitic Apid larvæ; the lateral region is less marked; the tuberculous thickenings nearly obsolete, and the whole body more attenuated, tapering rapidly towards the head and end of the abdomen, and is more cylindrical. The head is rather smaller in proportion than in the non-parasitic Apid larvæ. The very hard chitinous mandibles; the almost obsolete maxillæ, the thickened, rounded, entire labrum, with its 4 tubercles, the minute, faintly marked clypeus, the convex surface of the epicranium, not mesially depressed, with a subtriangular depression such as usually occur in non-parasitic larvæ of this family, are signs of degeneration, or at least of adaptation to its parasitic habits, and slightly reminds us of the head of dipterous larvæ. The absence of spinules on the surface of the tergum is noticeable.

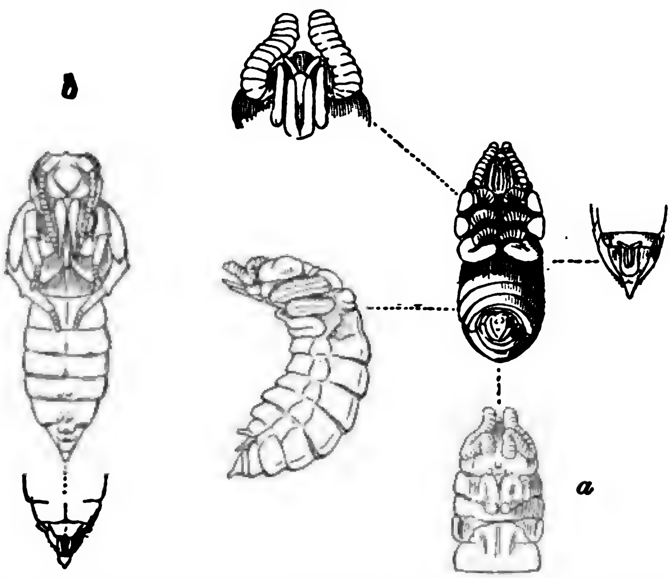

Fig. 8. *Nomada* probably *imbricata*, *a*, semipupa; *b*, pupa. × 3. (Emerton *del.*)

Nomada imbricata *Smith.*

Pupa.—The pupæ of both sexes occurred in the nests of *Andrena vicina.*

♂. Head not so broad as in *Andrena*. Ocelli situated in a curved raised line; on the upper and posterior edge of the orbit are three conspicuous spines, which are not present in the other genera, and are evidently of use in locomotion. Front of the head much narrower and depressed next to the orbits; the insertions of the antennæ are nearer together than in *Andrena*. Supraclypeal piece well marked, though the outlines are as yet indistinct. The clypeus is broad, subtriangular, the surface very convex. Labrum not distinct, separated by suture from the clypeus, somewhat triangular in form, with the front edge well rounded. Mandibles long, cylindrical, regularly incurved; tips unidentate, subacute. Antennæ stout, not clavate, reaching to the insertion of the posterior trochanter, also reaching just to the tips of the maxillary palpi; the joints as long as broad, each with a mesial constriction. From the labrum drops down a long slender pointed tongue-like piece (the epipharynx) into the base of the maxillæ (also present in the pupa of *Bombus*). The lingua reaches beyond the tip of the antennæ; the tip long, slender and pointed. Paraglossæ as long as the part of the

tip of the lingua extending beyond the end of the maxillæ. The 5-jointed labial palpi reach one-half way between the end of the lingua and the end of the maxillæ; the joints of both pairs of palpi rapidly decreasing in size; the maxillary palpi 6-jointed, reaching only to the tip of the maxillæ, thus being much shorter than the labial palpi, whereas in the pupa of *Andrena* they reach to and are parallel with the tips of the other pair. All the mouth parts are twice as long as in *Andrena*, and in this respect *Nomada* seems more allied to *Bombus*, etc., but otherwise, and in its elongated body especially, it is much lower. The legs are slenderer than usual, the tarsi folded on the breast as usual, the hind legs only reaching to the middle of the abdomen, which is unusually long and slender, the segments long, very convex, the sutures large, broad, deeply impressed, the hind edges much thickened, dentate beneath (not so in *Andrena*) showing that the pupa of this parasitic form probably moves about a good deal in its cell. On the hind edge of the 7th and 8th abdominal segments grow out a pair of tubercles, those on the 7th small and simple, the 2d pair (on 8th) very much larger and ending in a nipple-like papilla. The 9th sternite is square and slightly excavated at the edge, while the terminal (probably 10th) tergite is elongated into an acute extensible point tipped with black. These rhabdites agree well in form and position with those of ♂ *Andrena vicina*; they are, however, a little longer, more exserted, and the 10th tergite is longer, slenderer and more pointed.

Thorax: The mesial groove and parapsidal grooves of the mesothorax are deep and better marked than usual. The scutellum rises into two prominent tubercles which are larger than in *Andrena*, while the meta-scutellum is smaller, being small and scarcely tuberculated. The propodium is broad and flattened, contracting somewhat posteriorly. The hind tarsi are spinulated on the outer edge.

♀ differs from ♂ in the head being a little wider and the body thicker; the antennæ are of the length and size in both sexes, though differing in the adult, and the mouth-parts are precisely the same. Tip of the abdomen: ovipositor with three pairs of rhabdites almost entirely exserted; the tip is precisely as described in the ♂, ending in an acute prolonged point, and the square end of the 9th urite forming the under side of the anus is the same as in the ♀. (This identity in the pupa is interesting. The ♂ and ♀ external genitals seem to be strictly homologous in position though the genitals of the ♂ only consist of two pairs of appendages (rhabdites) arising from the 8th segment. The ♂ has one abnormal segment more, this being absorbed in the ♀. In the

abdominal ♂ tip of *Andrena* the 7th urite is rounded, triangular, covering in the two small rhabdites on the 7th segment; those on the 8th are large, smooth, full, simple, not ending in apapilla, as in *Nomada*; the 9th urite is full, not so flat and excavated or as deep as in *Nomada*; the 10th tergite rounder and shorter than in *Nomada*.

LIST OF DRAGONFLIES TAKEN NEAR BUFFALO, N. Y.

BY E. P. VAN DUZEE.

During the seasons of 1895 and 1896 I took up the collection of the local Neuropteroid insects as a recreation from the heavier work I had been doing on the Hemiptera. The time at my disposal was very limited, only a few half-days during the summer, therefore it is not likely that this list, which enumerates 41 species, is anything like a fair representation of our local Odonat fauna.

The principal localities mentioned are the following: Squaw Island and Black Rock Harbor, in Niagara River, are within the limits of Buffalo City. Ridgeway, Ont., is on the north shore of Lake Erie, twelve miles west of Buffalo, and Point Abino is just beyond. Between these stations is a large swamp separated from the lakes by sand-dunes, reaching in places a height of 100 feet. About here is by far the best collecting grounds within many miles of Buffalo. Stations at Tonawanda and Amherst are on a deep stagnant creek which affords excellent breeding grounds for many of the Dragonflies. Colden and Boston are 20 miles southeast from Buffalo, among hills about 600 feet in height, where the country is well wooded in places, and traversed by rapid streams. Lancaster, Elma and Hamburgh are on the level country, about 10 miles east and south from Buffalo. Clarence is farther east, and there and at Hamburgh are bog swamps that harbor many Odonata and other insects both interesting and distressing.

Several interesting localities not far from Buffalo have not yet been visited for the Odonata. Among these is Niagara Falls, and it is not improbable that this and other places at Chippewa, the lower end of Grand Island, etc., will yield numbers of fine species not on this list. Two or three species from the upper end of Grand Island taken by Mr. Philip Fischer have been included to make this list more complete.

For the determination of these Dragonflies I am indebted to the kind-

ness of Dr. D. S. Kellicott, and Mr. P. P. Calvert has kindly undertaken to revise the list and publish it in connection with his additions to the list of Dragonflies of New York State:

Calopteryx maculata *Beauv.* This pretty insect makes its home in deep woods and in gullies among the hills where a rift in the foliage admits the sunlight to the little pools that form along the hill-side streamlets. Here they often congregate in great numbers on the bushes overhanging the water. On the level country about Buffalo this species is rarely seen and then only near water in the heaviest woods.

Lestes uncata *Kirby.* June to August. I have taken this species only in boggy woods where the water rarely if ever dries away during the summer. In such situations it flies about the swampy openings where the hot rays of the sun make the mosquitos lively and the collector miserable.

Lestes rectangularis *Say.* Not common. Taken near deep stagnant streams in August and September.

Argia putrida *Hagen.* Through July and August this species is common along some of our smaller creeks where a rapid current is broken by projecting stones. I have never seen it near still water as recorded by Dr. Kellicott.

Argia violacea *Hagen.* Rare. Taken in company with the preceding species in August.

Erythromma conditum *Hagen.* Taken flying over a ditch of running water at Hamburgh, N. Y., in June.

Amphiagrion saucium *Burm.* Common about swampy places through July and August.

Enallagma carunculatum *Morse.* Very abundant from late June to September on Squaw Island in Niagara River and along the shores of Lake Erie where the shallow water is overgrown with reeds.

Enallagma hageni *Walsh.* Squaw Island, June 11th, two examples.

Enallagma exsulans *Hagen.* Taken immature at Black Rock Harbor about June 1st, and mature, in July in a bog swamp at Clarence.

Enallagma signatum *Hagen.* Numbers taken along a sluggish creek north of Williamsville in September.

Ischnura verticalis *Say.* This is the most abundant Agrion about Buffalo. It occurs in immense numbers on Squaw Island and along Niagara River and the shores of Lake Erie where fields of rushes

cover the shallow water. It it also common along all of our inland streams and ponds. Here they have been taken from May to September. The orange females appear to be more abundant than the blue.

Anomalagrion hastatum *Say*. Two males captured among the rushes on the shore of Lake Erie at Point Abino, August 8, 1896. The smallest of these expands but 20 mm.

Gomphus spicatus *Selys*. Taken in a tamarack swamp at Clarence in July, and rarely about Black Rock Harbor, in June.

Gomphus fraternus *Say*. Abundant along Niagara River in June. I have taken it only about still water.

Gomphus villosipes *Selys*. Taken on Grand Island, in Niagara River, by Mr. Philip Fischer, of this city.

Epiæschna heros *Fab*. Common. June and July. I can verify Dr. Kellicott's remark that this species seems to enter our houses from choice.

Boyeria (formerly **Fonscolombia**) **vinosa** *Say*. One example of this interesting species was taken by me from a bush in deep woods far up on a hillside at Colden, N. Y., August 11th, 1896. A little water run was near, represented then by an occasional pool, and here may have been the home of the larva.

Aeschna constricta *Say*. August and September. Taken immature in July. I have found this species most commonly in hilly country where a small brook meanders through open woods and pasture lands. In such places it is sometimes abundant. On the level country about Buffalo it is rarely seen.

Anax junius *Drury*. Common everywhere through June and July. I once watched one of these insects pursuing gnats about a spruce tree until it was so dark I could no longer discern him before the fading light in the western sky.

Macromia illinoiensis *Walsh*. Taken by Mr. Philip Fischer on Grand Island. In July, 1895, I saw an example of this species resting on a store window in the heart of the city.

Epicordulia princeps. Common about Black Rock Harbor through June and July.

Tetragoneuria cynosura *Say*. June. With the next.

Tetragoneuria semiaquea *Burm*. Very abundant at Black Rock Harbor during June, 1895. Early in the month they were mostly soft

and immature. But even when fully matured they were sluggish and easy to capture. By the middle of July they had mostly disappeared.

Tetragoneuria spinigera *Selys*. One female taken on the side of a house nearly a mile from the river in May. Dr. Kellicott identified this as *spinigera* with some doubt, but expressed himself as certain that it was distinct from either of the two preceding.

Somatochlora tenebrosa *Say*. One example of this beautiful insect was taken in a tamarack swamp at Clarence, N. Y., July 2, 1895.

Somatochlora linearis *Hagen*. Taken on Grand Island by Mr. Philip Fischer.

Tramea lacerata *Hagen*. One specimen taken in the city far from the water on August 20th.

Libellula basalis *Say*. Common through June and July along Niagara River and Tonawanda Creek, where the water is deep.

Libellula quadrimaculata *Linn*. Numbers seen about a springy spot among the hills in July, 1895. These, though perfectly mature, were of a rich olive brown color, becoming greenish on the mesonotum, and the black basal triangles on the hind wings were conspicuously veined with white. Though differing in some respects from typical examples, Dr. Kellicott pronounces them undoubtedly *quadrimaculata*.

Libellula semifasciata *Burm*. June and July. Rare about Buffalo, but seen in considerable numbers along the railroad ditches at Ridgeway, Ont.

Libellula pulchella *Drury*. June to August. Abundant everywhere but especially about Black Rock Harbor.

Plathemis trimaculata *De Geer*. Common around mill-ponds and stagnant pools everywhere in the country about Buffalo, but rarely seen along Niagara River.

Leucorhinia intacta *Hagen*. Very abundant on the stones and water plants in Niagara River and Black Rock Harbor through June and early July. This species shows much variation in the extent of the yellow markings on the abdomen and of the fulvous shade on the base of the wings. When fully colored it is a most beautiful insect. Back in the country it is rarely seen, only a few individuals find their home along deep sluggish streams.

Diplax rubicundula *Say*. Common from July to September. The immature taken in June.

Diplax obtrusa *Hagen.* Clarence, N. Y., July 2d; Elma, N. Y., September 15th and Ridgeway, Ont., August 10th.

Diplax costifera *Hagen.* Common along a dusty roadway near a mill pond, in the town of Amherst, September 2, 1895. Not seen elsewhere.

Diplax vicina *Hagen.* This species with *rubicundula* and *obstrusa* occur together in low, wet meadows and along small streams, but *rubicundula* is here much the most abundant form. I have also taken *vicina* among the reeds on the shores of Lake Erie, at Point Abino.

Diplax corrupta *Hagen.* The immature of this large species were abundant on reedy shores of Lake Erie, at Point Abino, on August 31, 1896. In this state their rich fulvous color varied with black and pale green, and their glossy golden wings spread out to the sunlight, made them beautiful objects. When mature the colors become obscured and the insect is much less attractive.

Mesothemis simplicicollis *Say.* Quite abundant along Tonawanda Creek, August 12, 1896. Here the females were depositing their eggs on the confervæ near the shore. In doing this they hovered a few inches above the water, dipping to the surface at intervals of a few seconds with a rhythmic vibratory motion, each time bringing the tip of the abdomen in contact with the aquatic weeds that were to serve as a nidus for their eggs.

Pachydiplax longipennis *Burm.* Rare. A few examples were found in June, 1895, about the Sagittaria in Black Rock Harbor.

ADDITIONS TO THE ODONATA OF NEW YORK STATE.

BY PHILIP P. CALVERT, Philadelphia, Pa.

In this JOURNAL for March, 1895 (Vol. III, No. 1, pp. 39–48) I published a list, with notes, of all the species of Odonata known to me to inhabit New York State. Soon after, Dr. Lintner sent me notes on the Odonata in the State Collection at Albany, including many made by Dr. Hagen, and also a considerable number of unidentified dragonflies for determination. This material and the results of its study have been referred to by Dr. Lintner in his recently published Eleventh Report as State Entomologist, for 1895, p. 105, and are here marked (L.). Professor Kellicott has kindly sent me a few notes which are designated

(K.). References are made to the paper by Mr. Van Duzee, in this number of the JOURNAL on the dragonflies of Buffalo (VD.). The original list embraced 85 species; we now know 102 species and varieties as found in this State.

A. ADDITIONAL NOTES ON SPECIES PREVIOUSLY LISTED.

SUBFAMILY CALOPTERYGINÆ.

1. **Calopteryx maculata** *Beauvois*. Schenectady, July 14, 1875; July 12, 1877; common at Le Grange's Mills, Guilderland, Albany Co., June 24, 1893 (L.). Buffalo (VD.).

5. **Hetærina americana** *Fabr.* Albany Co. (L.).

SUBFAMILY AGRIONINÆ.

9. **Lestes uncata** *Kirby*. Buffalo (VD.).

11. **Lestes forcipata** *Rambur*. Schoharie (L.).

12. **Lestes rectangularis** *Say*. New Baltimore, Schoharie (L.). Buffalo (VD.).

13. **Argia putrida** *Hagen*. Schoharie (L.). Buffalo (VD.).

14. **Argia violacea** *Hagen*. Buffalo (VD.).

16. **Erythromma conditum** *Hagen*. Hamburgh (VD.).

18. **Amphiagrion saucium** *Burm.* Centre, now Karner (L.), Buffalo (VD.).

20. **Enallagma civile** *Hagen*. "New York," Hagen, 1861. The specimens from Saratoga Lake cited in my previous list belong to no. 21.

21. **Enallagma carunculatum** *Morse*, instead of "*Enallagma*; sp. n." In addition to the Saratoga Lake specimens mentioned under no. 20—Three males, one female, Lake Pleasant, July 29, 1887; one male, Piseco Lake, August 29, 1888 (L.). (P. P. Calvert det.). Niagara, etc. (VD.).

22. **Enallagma ebrium** *Hagen*. Schoharie (L.).

23. **Enallagma hageni** *Walsh*. Lake Bluff at Huron; Lake Pleasant, July 10, 1887; Albany, July 6 (P. P. Calvert det.) (L.) Squaw Is. (VD.).

27. **Enallagma exsulans** *Hagen*. Black Rock, etc. (VD.).

28. **Enallagma signatum** *Hagen*. Williamsville (VD.).

29. **Ischnura verticalis** *Say*. Schoharie (L.). Annandale, June 19th, by Mrs. C. W. Throop; recorded by Dr. Lintner, 11th Rep. State Ent. N. Y., p. 288. Buffalo (VD.).

SUBFAMILY GOMPHINÆ.

34. **Ophiogomphus rupinsulensis** *Walsh.* Schoharie (L.).

36. **Gomphus brevis** *Hagen.* Schoharie (L.). Dr. Hagen's note on the specimen, according to Dr. Lintner, is "Possibly *G. quadricolor* of Walsh."

38. **Gomphus spicatus** *Selys.* Clarence, etc. (VD.).

39. **Gomphus fraternus** *Say.* Niagara (VD.).

40. **Gomphus adelphus** *Selys.* Kenwood, June 17, 1876 (L.). "Never [*i. e.*, previously?] seen by me; 1 ♂ in Selys' coll. from A. Fitch." Hagen, 1877.

41. **Gomphus villosipes** *Selys.* Grand Is. (VD.).

43. **Dromogomphus spinosus** *Selys.* Karner, Albany Co., June 7, 1870, Hagen det. (L.).

SUBFAMILY ÆSCHNINÆ.

45. **Epiæschna heros** *Fabr.* Albany (L.). Buffalo (VD.).

46. **Boyeria*** **vinosa** *Say.* Schoharie; one female, Piseco Lake, August 31, 1888, one male, Elk Lake, August 22, 1893 (P. P. Calvert det.) (L.). Colden (VD.).

48. **Æschna juncea** *L.* var. **verticalis** *Hag.* Schoharie (L.).

49. **Æschna clepsydra** *Say.* Schoharie (L.).

50. **Æschna constricta** *Say.* Schoharie (L.). Buffalo (VD.).

51. **Anax junius** *Drury.* Schoharie (L.). Buffalo (VD.).

SUBFAMILY CORDULINÆ.

53. **Epicordulia princeps** *Hagen.* Black Rock (VD.). Kenwood (L.). Albany, July 5th, within doors, by Mrs. A. Lansing; recorded by Dr. Lintner 11th Rep. State Ent. N. Y., p. 288.

54. **Tetragoneuria cynosura** *Say.* Black Rock (VD.). Staten Island, June, by Mr. W. T. Davis.

55. **Tetragoneuria semiaquea** *Burm.* Black Rock (VD.).

58. **Somatochlora tenebrosa** *Say.* Oswego Co., Aug. 23–25 (K.). Clarence (VD.).

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* Mr. McLachlan has pointed out (Ann. Mag. Nat. Hist. 6, xvii, p. 424, June, 1896,) that the generic name *Fonscolombia*, proposed by de Selys in 1883, was preoccupied by Lichtenstein for Hemiptera in 1877, and consequently suggests *Boyeria*—after Boyer de Fonscolombe—instead.

SUBFAMILY LIBELLULINÆ.

62. **Tramea carolina** *L.* Schoharie (L.)

63. **Tramea lacerata** *Hagen.* Buffalo (VD.).

64. **Libellula basalis** *Say.* Kenwood (L.). Niagara River, etc. (VD.).

69. **Libellula exusta** *Say.* One female, Croton on Hudson, May 17, 1896, by Mr. W. T. Davis.

70. **Libellula quadrimaculata** *L.* Schoharie; Karner, May 28, 1880, (L.). Buffalo (VD.).

71. **Libellula semifasciata** *Burm.* Buffalo (VD.).

72. **Libellula pulchella** *Dru.* Schoharie (L.). Buffalo, etc. (VD.).

73. **Plathemis trimaculata** *DeGeer.* Schoharie, Albany (L.). Buffalo (VD.).

74. **Micrathyria berenice** *Drury.* Sheepshead Bay, Long Island, July, 1889. (P. P. Calvert, det.) (L.).

77. **Celithemis eponina** *Drury.* Lake Bluff, Wayne Co., July 10, 1880 (L.).

78. **Leucorhinia intacta** *Hag.* Centre (now Karner), June 4, 1870, Hagen det (L.). Croton on Hudson, May 17, 1896, by Mr. W. T. Davis. Niagara River, etc. (VD.).

79. **Diplax rubicundula** *Say.* Buffalo (VD.).

81. **Diplax costifera** *Hagen.* Amherst (VD.).

82. **Diplax vicina** *Hagen.* Schoharie, Hagen det.; Piseco Lake, August 31, 1888 (P. P. Calvert det.) (L.) Buffalo, etc. (VD.).

84. **Mesothemis simplicicollis** *Say.* Tonawanda Creek (VD.).

85. **Pachydiplax longipennis** *Burm.* Black Rock (VD.).

B. SPECIES ADDED TO THE PREVIOUS LIST.

SUBFAMILY AGRIONINÆ.

86. **Lestes virgo** *Hagen* (sp. n.) [in MS.]. Lake Bluff, Wayne Co. (L.). (Not seen by the writer.)

87. **Lestes vigilax** *Selys.* "New York" (L.).

88. **Enallagma fischeri** *Kellicott.* Presumably Ithaca, in Cornell University Collection (K.).

89. **Enallagma geminata** *Kellicott.* Parish, August 24 (K.).

SUBFAMILY GOMPHINÆ.

90. **Ophiogomphus mainensis** *Packard.* Schoharie, Hagen 1877; Keene Valley, 1,000 feet elevation, July 6, 1892 (L.).

91. **Gomphus plagiatus** *Selys.* One male, Bethlehem, September, 1880 (P. P. Calvert det.) (L.).

92. **Gomphus amnicola** *Walsh.* Bethlehem; Hagen det. (L.).

93. **Gomphus descriptus** *Banks.* Ithaca, May 21, 1890; May 15, 1894; May 18, 1895. Recorded by Mr. Banks in this JOURNAL iv, p. 195.

SUBFAMILY CORDULEGASTERINÆ.

94. **Cordulegaster erroneus** *Hagen.* Keene Valley, 1895 (L.).

SUBFAMILY ÆSCHNINÆ.

95. **Æschna pentacantha** *Ramb.* Baldwinsville, Onondaga Co., June, by R. H. Pettit; recorded by Mr. Banks in Ent. News vi, p 124.

SUBFAMILY CORDULINÆ.

96. **Macromia illinoiensis** *Walsh.* Grand Is., etc. (VD.).

97. **Somatochlora walshii** *Scudder.* One male, Keene Valley Essex Co., Aug. 5, 1889. (P. P. Calvert det.) (L.).

98. **Somatochlora linearis** *Hagen.* Oswego Co., August 23–25 (K.). Grand Is. (VD.).

99. **Tetragoneuria spinigera** *Selys.* Buffalo (VD.).

SUBFAMILY LIBELLULINÆ.

79*a*. **Diplax rubicundula** *Say* var. **assimilata** *Uhler.* "New York" (L.).

100. **Diplax obtrusa** *Hagen.* Keene Valley, July and August; Piseco and Elk Lakes, August (P. P. Calvert det.); Centre (L.). Recorded from Hastings, Oswego Co., August and September, by Prof. Kellicott in Ent. News, vi, p. 239. Clarence, etc. (VD.).

101. **Diplax corrupta** *Hagen.* One male on the sea-shore near New Brighton, Staten Island, June 27, 1896, by Mr. Wm. T. Davis, and submitted to the writer for examination. Mr. Davis recorded that the frons, base of the wings and abdomen were scarlet in life. Compare also Mr. Van Duzee's paper. This is a common western species which perhaps is extending its distribution eastward. See also Trans. Am. Ent. Soc., xx, p. 264.

Dr. Lintner also mentions four species of Agrioninæ, indicated as new by Dr. Hagen, but these the writer has not seen.

GLUPHISIA SEVERA IN NEW JERSEY.

BY HARRISON G. DYAR.

Fourteen larvæ of this species were collected by Mr. Beutenmüller and the writer at Fort Lee, N. J., in May, 1896. The larvæ pupated early in Juns; imago in April, 1897, of the form *avimacula* Hudson. The food-plant was *Populus grandidentata*. Stages IV. and V. were observed, differing in no respect from Californian examples (see Dr. Packard's monograph, p. 98) eggs were obtained from a bred ♀. They correspond exactly with my description except that there is no black spot at the micropyle. This spot in the Californian egg was probably unnatural. The reticulation of the eggs are very small and rather obscure. This species is probably not particularly rare, but escapes observation on account of the unusually early date of appearance.

A NEW ALEURODES ON RUBUS FROM FLORIDA.

BY T. D. A. COCKERELL.

Aleurodes ruborum, sp. nov.

♀. Very minute, about or hardly 1 mm. long; body and legs pale lemon yellow; wings pure white, spotless. The main nervure appears to fork as in *Aleurodicus*, but only the lower branch is a real nervure, the nervure bending at the apparent fork, which is only a little more than half way from the base of the wing; the apparent upper fork is simply a fold. The second nervure arises from the main nervure nearly at the base of the wing. The margins of the wings, after maceration in caustic soda, appear delicately beaded. Eyes not completely divided. Antennæ 7-jointed, second joint excessively stout, its breadth at top, which is obliquely truncate, being at least as great as that of basal portion of femur. Third joint long, cylindrical, coarsely ringed throughout; fourth short and oval, broader than third; fifth narrow, cylindrical, a little longer than fourth, and very much narrower; sixth cylindrical, almost or quite as long as 4+5; seventh shorter than sixth, but longer than fifth; third about as long as 4+5+6. Anterior tibia very slender, its distal end swollen. Middle and hind tibia not nearly twice as long as their tarsi. Genitalia ordinary.

Pupa: About ¾ mm. long, oval, flat, delicately transversely ribbed, with a delicate fringe of long, glossy rods, easily broken off; the longest of these rods may be almost or quite as long as the breadth of the pupa. Color of pupa black; by transmitted light after boiling in caustic soda extremely dark vandyke brown. Margin presenting at intervals round, clear orifices, about 14 on each side. Vasiform orifice an elongate triangle, the base about two-thirds the length of a side; operculum heart-shaped, or approximately so, with the corners rounded and the base about as long as a side; lingua projecting only a little beyond, the projecting portion semilunar in outline, showing scme tendency to crenulation, after the manner of *A. erigerontis*.

Habitat: Pupæ abundant on under sides of leaves of a cultivated *Rubus* at Lake City, Florida, sent by Mr. A. L. Quaintance. Imago emerging at the middle of February. As this occurred on a cultivated *Rubus*, Mr. Quaintance thought it barely possible it might be an introduced species, but it is probably native in Florida. It certainly is not the European *A. rubi* Signoret, which is more or less marked with black, and has black legs and spotted wings. More nearly it resembles the English species *A. rubicola* Douglas, 1891, which has a yellow body and immaculate white wings; but in *rubicola* the pupa is not black, there is not the fringe of our species, the lingua projects much more beyond the operculum, and there are decided differences in the legs and antennæ of the imago.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF JUNE 16, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Ten members present.

The evening was devoted to a discussion of the best methods of mounting and preparing of insects.

The Treasurer reported the balance of the JOURNAL fund as $368.06 and the Society fund as $133.73.

Mr. Beutenmüller read a notice from the Philadelphia Society about the 4th, of July excursion.

MEETING OF SEPTEMBER 15, 1896.

Held at the American Museum of Natural History.

Mr. Beutenmüller was elected temporary chairman. Nine members present.

The Treasurer reported on the funds of the Society.

The Executive Committee was instructed to organize, and devise ways and means to increase the membership and to invest the money of the Society.

The following resignations were reported and accepted: H. Aich, D. H. Ray, G. D. Hulst, A. Smith.

Col. Nicolas Pike was proposed as an active member by Mr. Beutenmüller. A number of rare coleoptera were exhibited by Messrs. Schaeffer, Meitzen and Joutel and after discussion the meeting adjourned.

MEETING OF OCTOBER 6, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Seventeen members present. Visitors: Dr. George H. Horn, of Philadelphia, and Mr. Blackburn.

Treasurer reported a bill of $24.00 from the Scientific Alliance as the Society's share of the expenses for the year.

The Executive Committee reported that card-cases to contain cards giving the meeting days and other information of the Society be placed at the Museum and other similar places, and that the moneys of the Society be deposited in the name of the Society.

Dr. Ottolenqui moved that the publication committee publish a new list of Lepidoptera, with Dr. Dyar as editor. After discussion the motion was lost, owing to the want of funds.

Mr. Blackburn was proposed as active member by Mr. Beutenmüller.

Mr. Palm spoke of the Coleoptera collected by Mr. Kunze in Arizona, in which he said that *Plusiotis lecontei* was found in the sawdust of old saw-mills, and that *Dynastes grantii* was found in numbers in the tops of ash trees.

Mr. Joutel exhibited the flowers of the cruel-plant with insects hanging from them, and he explained the manner in which the insects were caught by the flowers.

Dr. Horn gave an informal talk about the region gone over by Mr. Kunze and also about Coleoptera generally. The meeting then adjourned.

MEETING OF OCTOBER 20, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Twelve members present.

Colonel Nicholas Pike and Mr. C. V. Blackburn were elected as active members.

Dr. H. G. Dyar spoke on the first larval stage of the Eucleidæ (Limacodidæ). This stage was discribed of ten different species inhabiting New York, and the relations of the species to each other were shown. The results confirm the position assigned to the family on larval characters derived from the adult larvæ, leading back to an ancestral form from which the whole group may have been derived. It appears that this ancestral form must have been more like *Lagoa* than any other known larva, a conclusion entirely in harmony with the author's previous results.

Mr. Joutel gave a few additional notes on the cruel-plant (*Physianthus albens*). After discussion of both subjects the meeting adjourned.

MEETING OF NOVEMBER 17, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Ten members present.

Dr. Seifert spoke of the experiments he was making with the larvæ, pupæ and eggs of moths and butterflies with a view of finding the effects of heat and cold on them. The results were very marked, as shown by the dark forms of *Arctia arge*, produced by cold and the light ones by heat, when placed near a series of normal specimens. Many of the pupæ, eggs and larvæ were kept in 120° Fahr. for 100 hours, others were frozen. He found that the eggs of some species slowly developed in a freezing temperature.

President Zabriskie exhibited several crickets from Florida.

Mr. Beutenmüller gave an account of the capture of the dog's-head butterfly on Staten Island by Mr. Wm. T. Davis. He also said that it was probable that the larva of *Everyx versicolor* spun a slight cocoon and pupated in the branches of its food plant, which grows in swamps where there is always more or less water on the ground, so that it would be unable to pupate like the others of the genus. After discussion the meeting adjourned.

MEETING OF DECEMBER 1, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Eighteen members and six visitors present.

Dr. Horn was expected to give a talk on Coleoptera, but was unable to attend on account of sickness. A general discussion of insects took place.

Mr. Beutenmüller gave a preliminary account of some of the insects caught during his trip through North Carolina, among which were *Nomaretus debilis*, *Cychrus andrewsii*, *C. bicarinatus*, *Pterostichus blanchardi* and several species of *Platynus*.

MEETING OF DECEMBER 15, 1896.

Held at the American Museum of Natural History.

Mr. Beutenmüller was elected temporary chairman. Twelve members present.

A letter of regret from Dr. Horn was read explaining his absence at the last meeting.

Messrs. Palm, Groth and Joutel were appointed a committee to nominate officers for 1897.

Mr. Beutenmüller read a paper on "A trip to the land of the sky in Western North Carolina," in which he gave a description of the scenery and people as well as some amusing incidents of travel and spoke of the insects he caught, among which, besides those exhibited at the last meeting, were a host of Hymenoptera, Diptera and Lepidoptera; he also exhibited a number of photographs illustrating the trip.

MEETING OF JANUARY 5, 1897.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Ten members present.

Dr. G. Lagai and Miss Margaret Jaggers were proposed for active membership.

The Nominating Committee reported on officers for 1897: For President, Chas. Palm; Vice-President, E. G. Love; Treasurer, C. F. Groth; Recording Secretary, L. H. Joutel; Corresponding Secretary, H. G. Dyar; Executive Committee: Messrs. J. L. Zabriskie, O. Dietz, E. G. Love, C. F. Groth, H. G. Dyar; Publication Committee: Messrs. E. Daecke, C. Schaeffer, L. H. Joutel, Wm. Beutenmüller.

On motion the Recording Secretary was requested to cast an affirmative ballot, and the candidates were declared elected.

The Treasurer read his annual report, which was referred to the executive committee for auditing and to report to the Socicty thereon.

A vote of thanks was given to the retiring officers.

The advisability of holding an annual exhibition of insecets was discussed and the matter was referred to the Executive Committee for action.

Mr. Beutenmüller called attention to Dr. Packard's work on the monograph of the Notodontidæ, saying that it was one of the best monographs extant and ought to be in the possession of every student of Lepidoptera. A limited number of copies were in the hands of Dr. Packard and to be had for $15 per copy.

MEETING OF JANUARY 19, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Twelve members present.

Dr. G. Lagai and Miss Margaret Jaggers were elected active members.

The resignation of Mr. Birnbaum was read and laid over to next meeting.

The President appointed Messrs. Munch and Schaeffer on the Field Committee and Messrs. Beutenmüller and Love on the Scientific Alliance Committee.

The Committee on Constitution reported on the revised constitution and by-laws, which were adopted and ordered printed.

MEETING OF FEBRUARY 2, 1897

Held at the American Museum of Natural History.

Vice-President Love in the chair. Eleven members present.

The Auction Committee reported that a number of insects had been donated to the society by Messrs. Ottolenqui and Dyar.

It was decided to appoint a committee of three to devise ways and means of increasing the membership of the Society.

Dr. Ottolenqui exhibited a series of *Ecpantheria scribonia* showing the typical form merging into the form *denudata*, and questioned the correctness of the variety, saying it was only a worn specimen. Dr. Dyar replied by saying that in the true *denudata* the scales did not hold very well and were sooner lost than in the typical *scribonia*. He also showed a series of *Nadata gibbosa*, in some of which the white in the fringes was entirely absent and in others only represented by one or two white scales, thus agreeing with the description of *doubledayi*, and proving that it was a synonym of *gibbosa*. He mentioned that *Clisiocampa distria* was very common and destructive in New Hampshire the past summer.

Dr. Dyar spoke on a winter trip to Miami, Fla. He described the country and mentioned the species of Lepidoptera seen. Insects were not abundant, but two especially interesting Lepidopterous larvæ were found; the first was the larva of the little black Euchromian *Syntomedia minima*, which has only recently been found in Florida. The larvæ occurred sparingly and were observed in all their stages. The larva is red, tufted with dark grey hairs resembling somewhat some of the species of *Euchætes*, but with the warts of an Euchromian, not an Arctian. The second species was discovered on the Mangrove while rowing up the Miami river. It is the larva of *Eupoeya slossoniæ* Pack., a moth whose family position has been in dispute. Dr. Packard described the form as a "new species of Limacodes-like moth," while Dr. Dyar had considered it Megalophygid. The larva proved to be a true Eucleid closely allied to *Phobetron*. Dr. Dyar described its most essential characters, showing that it was in effect a green *Phobetron* on which had been superimposed the special adaptation of our *Sisyrosea textula* (*inornata*).

Mr. Doll showed an example of *Catocala elda* bred from a larva found on Long Island, on silver poplar. He also showed a beautiful aberration of *Anisota stigma* suffused with black, and one of *Melitæa chalcedon*, also a cross evidently between *Limenitis ursula* and *disippus*. He also had several aberrations of *Cecropia*, one of which had the transverse band crowded to the edge of the wings, making a unique insect.

Dr. Seifert exhibited some Lepidoptera showing the effects of heat and cold on eggs and pupæ. The Lunas which he showed had the eggs frozen twenty days. The eggs of *V. antiopa* were kept frozen thirty days, the effect on the imagos was a general loss of brightness in the males and a gain in the females. The October brood were most affected.

MEETING OF FEBRUARY 16, 1897.

Held at the American Museum of Natural History.

Vice-President Love in the chair. Thirteen members present.

The resignation of Dr. Kretz was read and accepted.

The Auction Committee reported that Mrs. Slosson and Mr. Doll had donated a number of insects for the Journal fund, a list of which was read.

Dr. Love appointed Messrs. Beutenmüller, Schaeffer and Joutel as a committee to increase the membership of the Society.

The Publication Committee reported that arrangements were being made to give a series of lectures to the public and asked for a sum of money to defray the expenses; on motion the sum of fifty dollars was set aside for the purpose.

Dr. Love showed specimens of *Phyllotreta armoraciæ*, an imported beetle, and said they were very common in Wisconsin and were doing considerable damage. They were very partial to horse-radish.

Mr. Beutenmüller showed some Papilio chrysalids with the imagos among which were those of *thoas* and *cresphontes*. He pointed out the differences in their shape and characters which proved that they were not varieties, as some authors had claimed, but distinct species. He also pointed out the differences between *P. bairdii*, *asterias* and *oregonia*, stating that *bairdii* was a variety of *oregonia* and not of *asterias*, and also spoke on the relationship between *brevicauda* and *asterias*. The chrysalid of *Ornithoptera*, sp. and *Papilio philenor* were almost identical in shape but differed in size.

Mr. Joutel spoke of the close resemblance of grasshoppers to leaves and showed two remarkable examples from Brazil.

MEETING OF MARCH 2, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Ten members present.

A note from Mr. Morris K. Jessup was read, giving the use of the large lecture hall of the Museum for the Society's lectures.

A letter from the Scientific Alliance asking for nominations by the Society of a person to receive the first grant of the Newberry fund was read. After discussion the Corresponding Secretary was requested to notify the Secretary of the Scientific Alliance that this Society had no candidate to propose.

Mr. Beutenmüller read a paper by Mr. William T. Davis, entitled, Intelligence Shown by Caterpillars in Placing Their Cocoons (see antea, p. 42).

In a discussion by the members the opinion was expressed that the cases cited were accidental and were not a sign of intelligence.

Mr. J. Doll showed a series of *Pseudohazis* in which the variation was well shown, it being impossible to tell where one species finished and the other began, the differences being evidently only local variations.

MEETING OF MARCH 16. 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Eleven members present.

The following resolutions were adopted:

WHEREAS, The present rate of postage on specimens of natural history to foreign countries being the same as letter rates, a burden some and excessive rate, and

WHEREAS, An amendment is to be proposed at the next International Postal Congress (amendment to Article XIX (samples), 4 of the Regulation of Details and Order) whereby such subjects shall be admitted to the mails at the rate of samples of merchandise.

Therefore, be it *Resolved*, That it is the sense of the New York Entomological Society that the amendment should be adopted, and

Resolved, That the Postmaster-General be requested to instruct the American delegate to vote for the same.

The delegates of this Society were requested to also bring the resolutions before the Scientific Alliance.

The President appointed Messrs. E. G. Love, J. L. Zabriskie and H. G. Dyar to act as auditors for 1897.

Mr. Loos on behalf of the Agassiz Chapter asked permission to join our field meetings. On motion the Chapter was invited to take part in our field meetings.

The Publication Committee reported that they had arranged for two lectures; one by Prof. Lyman A. Best, on Insect Mimicry, on April 10th, and the other by Dr. E. G. Love on the Study of Insects and their Transformations on April 24th.

Mr. Zabriskie exhibited the secondary parasites on *Chlamys plicata*, the generic name of which he stated was *Teterasticus*. He also showed the parasite from the eggs of *Chelymorpha argus*.

A paper on the Protective value of Action, Volitional or otherwise in "Protective Mimicry," by Mr. F. M. Webster, was read and discussed by the members (antea, p. 67).

MEETING OF APRIL 6, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Ten members present.

The Corresponding Secretary reported that he had sent the Resolutions on postage, which were offered at the last meeting, to the Postmaster General. Dr. Dyar was instructed to notify other scientific societies of the resolutions, and to request their coöperation.

A request from the Swiss Entomological Society, to exchange publications was received and referred to the Publication Committee.

Tickets for the annual reception of the New York Microscopical Society were received and acknowledged with thanks.

The Publication Committee reported that final arrangements had been made for the two public lectures by the Society, and tickets for the same were distributed.

Dr. Dyar spoke on the geographical distribution of the Eucleidæ with relation to past geological conditions. Maps of the former distribution of land and water were shown, so far back as the early Mesozoic (Triassic). It was shown that on the assumption that the Eucleidæ had never crossed considerable areas of water, that it was necessary to regard their origin as dating from this early period. Their present geographical distribution was also explained. There are no known fossils in this family, which renders direct palæontological evidence unavailable. Mesozoic insects in general are known to be similar to those now existant as remarked by Germar, and Bar is of the opinion that the absence of flowers in the Carboniferous is no proof of the absence of Lepidoptera. A mine of a Tineid is known from the Cretaceous. Now the Eucleidæ, in respect to the moths are not so highly specialized as many Tineids, and it seems possible that they may have existed in the Triassic in spite of the absence of fossil Lepidoptera an order which seems unusually poorly represented in the rocks. However, Dr. Dyar showed conditions which may have been capable of transporting the Eucleidæ across areas of water, showing that the present argument may be more interesting than conclusive. After discussion, adjournment.

PRELIMINARY LIST OF INSECTS TO BE SOLD AT AUCTION BY THE NEW YORK ENTOMOLOGICAL SOCIETY.

The sale will take place early next fall, and date, as well as a final list, will be given in the September number of the JOURNAL. For further information apply to L. H. Joutel, 164 E. 117th St., New York, who will also take charge of bids of those who cannot attend the sale.

COLEOPTERA.

Cicindela var. splendida.
" cuprescens.
" var. media.
Omophron gilæ.
Cychrus angusticollis.
Calosoma externum.
Pasimachus strenuus.
Dasychirius obesus.
Morio monilicornis.
Pterostichus subcordatus.
" isabellæ.
" appalachius.
" rostratus.
Evarthrus engelmanni.
Dicælus elongatus.
Chlænius erythropus.
" prasinus.
Necrophorus pustulatus.
Brachyacantha 10-pustulata.
Melasis pectinicornis.
Cebrio bicolor.
Gyascutus obliteratus.
Buprestis lauta.
" lineata.
Melanophila notata.
Thrincopyge ambiens.
Polycesta californica var. elata.
Acmæodera pulchella.
" variegata.
Dolichosoma foveicolle.
Elasmocerus terminatus.
Cymatodera inornata.
" ovipennis.
Clerus ichneumoneus.
Ichnea laticornis.
Amphicerus punctipennis.
Photuris frontalis.
Strategus antæus.
Mallodon dasystomus.
Eburia quadrigeminata.
Elaphidion inerme.
" parallelum.
Molorchus longicollis.
Heterachthes 4-maculatus.
Purpurecenus humeralis.
Stenosphenus notatus.
Calloides nobilis.
Neoclytus devastator.
Leptura gigas.
Ipochus fasciatus
Lagochirus araneiformis (Fla.).
Leptostylus biustus.
Lypsimena fuscata.
Monohammus titillator.
Saperda puncticollis.
" discoidea.
Euryscopa lecontei.
Coscinoptera vittigera.
Bassareus lituratus.
Cryptocephalus leucomelas.
Phyllobrotica lurida.
Creburius larvatus.
Adimonia externa.
Oedionychis miniata.
Argopistes scyrtoides.
Microrhopala erebus.
Cassida bivittata.
Phlœdes diabolicus.
Cryptoglossa verrucosa.
Eleodes pimelioides.
" opaca.
Polypleurus nitidus.
Amphedora nigrophilosa.
Blapstinus sordidus.
" pulverulentus.
Phaleria limbata.
Platydema ellipticum.
Ditylus cæruleus.
Cephaloon lepturides.
Mordella inflammata.
Pyrota mylabrina.
Cantharis nuttalli.
" cyanipennis.
Thecesternus humeralis.
Artipus floridanus.
Gononotus lutosus.
Eudiagogus pulcher.
Plinthus carinatus.
Pissodes strobi.
Dorytomus mucidus.
Chalcodermus æneus.
Rhynchophorus cruentatus.
Pachnæus distans.
Brenthus anchorago.

LEPIDOPTERA.

Danais berenice.
Argynnis montinus.
" freya.
Grapta faunus.
Junonia cœnia ex larva.
Eunica tatula (Fla.).

Argynnis frigga.
" eurynome.
Apatura clyton.
Victorina steneles.
Anæa troglodyta (Fla.).
Erebia descoidalis.
" epipsodea.
Chionobas chryxus.
" jutta.
Eumenia atala.
" larva and pupa.
Thecla acis (Fla.).
Neophasia menapia.
Pieris ilaire.
Colias elis.
Parnassius clodius.
Papilio zolicaon.
" eurymedon.
" daunus.
" rutulus.
Erycides batabano.
Thyreus abbotii, ex larva.
Philampelus achemon, ex larva.
Everyx myron var. cnotus.
Pseudosphinx tetrio.
Dilophonota ello.
" edwardsii.
Cautethia grotei.
Pachylia ficus.
Sphinx luscitiosa, ex larva.
" plebeius, ex larva.
" albescens.
" eremitus, ex larva.
Dolba hylæus, ex larva.
Paonias astylus, ex larva.
Sciapteron dollii.
Composia fidelissimia.
Alypia langtonii.
" wittfeldii.
Psychomorpha epimenis.

Exoprosopa fascipennis.
Anthrax lucifer.
" limatula.
" alternata.
" fulvohirta.
" fulviana.
Stratiomyia picipes.
Volucella esuriens.
" pusilla.
Therioplectes trispilus.
Tabanus fronto.
Calliphora groenlandica.
Spilomyia 4-fasciata.

Isodontia philadelphica.
Zethus slossonæ.
Zethus spinipes.
Microbembex monodonta.
Sphæropthalma mutata.
Monobia quadridens.
Vespa carolina.

Timetes petreus (Fla.).
Anartia schonherri.
Burtia belæ.
Cosmosoma omphale.
Syntomedia minima.
Euchromia epilais.
Callimorpha contigua.
Arctia nevadensis.
" incorrupta.
" phyllira.
" docta var. a.
" determinata.
" figurata.
Seirarctia echo.
Phragmatobia rubricosa.
Ecpantheria permaculata.
Halisidota cinctipes.
" labecula.
Parorgyia plagiata.
Oiketicus abbotii.
Laria rossii (rare).
Lagoa pyxidifera.
" opercularis.
Phryganidia californica.
Ichthyura apicalis.
Notodonta basitriens.
Pheosia portlandia.
Coloradia pandora.
Sphingicampa bicolor.
Anisota virginiensis.
Heteropacha rileyana.
Hepialus argenteomaculatus.
" gracilis.
Plusia contexta.
" vaccinii.
" simplex.
Agrotis rubristrigata.
Panopoda rufimago.
Calpe canadensis.

DIPTERA.

Hermetia illucens.
Physocephalus excisus.
Bombylius mexicanus.
Chrysops flavidus.
Pyrgota undata.
Baccha fuscipennis.
Proctacanthus brevipennis.
Echinomyia florum.
Plecteria flaviventris.
Dasyllis posticata.
Calabata fasciata.
Cyrtopogon chrysopogon.

HYMENOPTERA.

Megachila melanophœa.
" xylocopoides.
Urocerus abdominalis.
Polybia cubensis.
Trypoxylon collinum.
Melissodes bimaculata.

ANNOUNCEMENT.

The annual auction sale of insects for the benefit of the JOURNAL FUND, will be held NOVEMBER 16th, 1897, at No. 141 East 40th St., N. Y., when the insects listed in the June number of the JOURNAL and those in the present list will be sold to the highest bidder.

Those who cannot attend the sale in person may send their bids to L. H. JOUTEL, 164 East 117th Street, New York, who will furnish any information desired.

THE PUBLICATION COMMITTEE.

Additions to the list of insects published in the June number of the JOURNAL:

COLEOPTERA.

Cychrus Andrewsii.
Calosoma lugubre.
Bembidium erosum.
" aproximatum.
" striola.
" pictum.
" lorquinii.
Platynus fossiger.
" sinuatus.
Pterostichus validus.
" adoxus.
Hippodamia glacialis.
Tritoma festiva.
Chrysobotrys octocola.
Megapenthes stigmosus.
Dicerca tenebrosa.
Canthon vigilens.
Aphonus castaneus.
Phymatodes thoracicus.
Callimoxys fuscipennis.
Toxotus vestitus.
" cylindricollis.
Leptura cordifera.
Leptura canadensis.
" chrysocoma.
" vittata (yellow legs).
" crassipes.
" nigrella.
" aspera.
Pogonocherus mixtus.
Acanthocinus obsoletus.
Saperda vestita.
" tridentata.
" lateralis.
Trichodes Nuttalli.
Coscinoptera vittigera.
Saxinis saucia.
Lina obsoleta.
Monoxia consputa.
Disonycha quinquevittata.
Phalera longula.
" globosa.
Rhipiphorus limbatus.
Rhynchites æneus.
Pterocolus ovatus.
Rhinoncus pyrrhopus.

LEPIDOPTERA.

Ellema bombycoides.
Cressonia juglandis.
Pamphail massasoit.
Sanninoidea exitiosa ♂ ♀.
Cerathosia tricolor.
Arctia trivittata.
" parthenice.
" virgo.
" virguncula.
Arctia nais.
" phalerata.
Orgyia definita.
Parorgyia clintonii.
Ichthyura vau.
Gastropacha americana.
Polygrammate hebraicum.
Alaria florida.
Plusia contexta.

HYMENOPTERA.

Xenoglossa strenua.
" patricia.
Xenoglossa pruinosa.

Blown larvæ of Orgyia gulosa.

JOURNAL

OF THE

New York Entomological Society.

Vol. V. SEPTEMBER, 1897. No. 3.

NEW SPECIES OF TENTHREDO.

By ALEX. D. MACGILLIVRAY, Ithaca, N. Y.

The species described below are arranged analytically so that the labor of reading descriptions in determining specimens may be reduced to a minimum. The grouping is the same as that used by Norton in the Transactions of the American Entomological Society and consequently can be compared directly with it.

1. Antennæ wholly or in part pale 2
   Antennæ wholly black 5
2. Antennæ wholly pale 3
   Antennæ in part black 4
3. Abdomen black at base and rufous at apex, with the basal plates rufous. **redimaculus** *MacG.*
   Abdomen entirely black. ♀.—Black, with the following parts whitish-fuscous: the labrum, the base of the mandibles, the apical half of the front femora beneath, and a square spot on the sides of the basal plates; the antennæ pale luteous beyond the second segment; the clypeus squarely emarginate; the third segment of the antennæ one-fourth longer than the fourth; wings hyaline, very slightly infuscated; the veins, including the costa and the stigma, black. Length, 12.5 mm. Habitat.—Jay, Vermont (A. P. Morse.) **dubitatus**, sp. nov.
4. Abdomen rufous beyond the basal plates .... **basilaris** *Prov.*
   Abdomen rufous beyond the third segment .... **bilineatus** *MacG.*
5. Head more or less yellow above the base of the antennæ 6
   Head black above the base of the antennæ 12
6. Abdomen wholly or in part yellow 7
   Abdomen wholly or in part rufous 9
7. Pectus pale 8
   Pectus black. ♀.—Black, with the following parts yellow: the clypeus, the labrum, the mandibles except at apex, a triangular spot between and beneath the antennæ, the lower half of the cheeks, an ovate spot above the base of each antennæ, the inner margin of the eyes (interrupted opposite the bases

of the antennæ, extending beyond the eyes, and dilated behind), a spot on the collar, the tegulæ, a large spot above the anterior coxæ, a large spot on the pleuræ, an oblique line on the metapleuræ, a spot above the posterior coxæ, the scutellum, the legs, including the coxæ, except a black line above and the apices of the posterior tarsi, and a longitudinal band on each side of the basal plates and abdomen (appearing as a lateral margin to the tergum and the venter, its mesocaudal angles on each dorsal segment produced internally, and a narrow line on the caudal margin of the ventral segments); the clypeus emarginate; the third segment of the antennæ one-third longer than the fourth; the wings hyaline, slightly clouded; the veins, including the costa, black; the stigma brownish, paler beneath. Length, 10 mm. Habitat.—Olympia, Washington (Trevor Kincaid)....**perplexus**, sp. nov.

8. Posterior tibiæ black above. ♂.—Black, with the following parts yellow: the clypeus, the labrum, the mandibles except at apex, the face beneath the antennæ, an ovate spot above the base of each antenna, the cheeks almost entirely, the inner margin of the eyes (reaching beyond the eyes and dilated behind), a broad line on the collar, the tegulæ, a large spot above the anterior coxæ, the mesopleuræ and the metapleuræ except a narrow black line between them, the scutellum, the postscutellum, the basal membrane, the sides of the basal plates, a line on the posterier margin of the basal plates, the prosternum, the pectus, all the legs except a black line above and the posterior tarsi, the venter, the first and the second segments of the tergum except a black spot at base, and the remainder of the tergum; the clypeus squarely emarginate; the third segment of the antennæ one-fourth longer than the fourth; the wings hyaline; the veins, including the costa, black; the stigma black, brownish at base and apex. Length, 10–11 mm. Habitat.—Olympia, Washington (Trevor Kincaid); Juliætta and Moscow, Idaho (Professor J. M. Aldrich)............................**linipes**, sp. nov.

Posterior tibiæ black at apex. ♀.—Black, with the following parts yellowish-white: the labrum, the clypeus, the mandibles except at apex, the cheeks, a spot above the base of each antenna, the tegulæ, a large spot on the collar, a spot above the anterior coxæ, a broad stripe on the pleuræ, a spot above the posterior coxæ, the front and middle coxæ except above, the apices of the posterior coxæ, the trochanters, the front legs beyond the coxæ (the tibiæ and the tarsi are greenish), the middle femora (one specimen has a small black spot on the apex above), the middle tibiæ except a black spot at apex above, the basal segment of the middle tarsi beneath, the basal half of the posterior femora, the posterior tibiæ except at apex, the scutellum, a line on the postscutellum, the basal plates, the venter except the apical segment and the sheaths of the ovipositor, and the sides of the segments of the tergum (their inner caudal angles dilated along the caudal margin of the segments, coalescing at middle) except on the fifth segment (the black on the middle of the tergal segments is in the shape of a wide equilateral triangle, in one specimen the fourth segment is entirely pale); the clypeus emarginate; the third segment of the antennæ twice the length of the fourth; the wings hyaline, slightly infuscated towards the apex; the veins and the costa black; the stigma fuscous, paler beneath. Length, 11 mm.

♂.—The markings have more of a greenish tinge, with the following differences in the arrangement of the pale markings: a spot on the middle of the pectus, the five basal ventral abdominal segments (the remainder black), and the apical two-thirds of the third and the fourth segments of the tergum yellowish (the following segments black). Length, 11 mm. Habitat.—Olympia, Washington (Trevor Kincaid); Seattle, Washington (S. Bethel). **obliquatus**, sp. nov.

9. Pectus pale...10
Pectus black...11

10. Anterior tibiæ with a black line above. ♂ ♀.—Black, with the following parts yellowish-white: the clyepus, the labrum, the mandibles except at apex, the face below the antennæ, a line on the inner orbits extending half way to the caudal margin of the head, the cheeks broadly, the collar, the tegulæ, the pronotum at side, the V-spot, two spots on the postscutellem, the caudal portion of the metathorax, the prosternum, the pectus, the pleuræ, a line at the base of the wings, a spot above the posterior coxæ, the sides of the basal plates, the venter, the coxæ and trochanters, the anterior femora except a short line at apex above, and the remainder of all the legs except a black line above and the most of the posterior tibiæ; the tergum beyond the third segment, including the saw-guides, rufous; the third segment of the antennæ twice as long as the fourth; the wings hyaline; the veins black; the stigma pale at base. Length, 10 mm. Habitat.—Franconia and Mt. Washington, N. H. (Mrs. Annie Trumbull Slosson).............**secundus**, sp. nov.

Anterior tibiæ wholly pale. ♀.—Black, with the following parts yellowish-white: the clypeus, the labrum, the mandibles except at apex, the cheeks entirely, the inner margin of the eyes, extending beyond the eyes (the cephalic margin of the black spot on the vertex trilobed), a spot on the collar, the tegulæ, a spot above the anterior coxæ, the V-spot, a broad angulate mark on the pleuræ, a line on the metapleuræ, a spot above the posterior coxæ, a spot on the pectus, the postscutellum, the basal membrane, the sides of the basal plates, the first abdominal segment, the venter at base, and the front legs beneath; the legs rufo-luteous except the parts named above and a black spot on the apex of the anterior femora above and a black ring on the basal one-third of the posterior tibiæ; the five apical abdominal segments, including the venter, rufous; clypeus squarely emarginate, the third segment of the antennæ one-third longer than the fourth; the wings hyaline, slightly yellowish; the veins brown; the costa and the stigma luteous, the apex of the stigma brownish. Length, 12 mm. Habitat.—Winchendon, Massachusetts (A. P. Morse).......................................**simulatus**, sp. nov.

11. Anterior tibiæ black above.........................***magnificus** *MacG.*
Anterior tibiæ wholly pale. ♀.—Black, with the following parts yellow: the clypeus, the labrum, the front beneath the antennæ, a spot above the base of each antenna, an ovate spot at the inner angle of the eye, the cheeks, the collar, the tegulæ, a triangular-shaped mark on the pleuræ, the posterior mesal portion of the pectus, the front and middle coxæ, the posterior coxæ

* This species was originally described as a *Macrophya.*

except at base, the trochanters, the front and middle femora except a black line above, the front tibiæ except a dash above at base, the middle tibiæ except a black line above, the posterior femora at base, the posterior tibiæ beneath slightly at base, the front and middle tarsi and the apical segment of the posterior tarsi, a spot above the posterior coxa and the side and venter of the basal plates and the three basal abdominal segments; the abdomen, except the saw-guides, rufous beyond the third segment; the third segment of the antennæ one third longer than the fourth; the wings hyaline, very slightly yellowish; the costa, the stigma, and the veins luteous; the clypeus broadly and roundly emarginate. Length, 11 mm. Habitat.—Mt. Washington, N. H. (Mrs. Annie Trumbull Slosson.) .... **novus,** sp. nov.

12. Pectus pale.. 13
Pectus black...21

13. Posterior femora wholly or in part pale above 14
Posterior femora black above.......................................17

14. Posterior femora fulvo-ferruginous or sanguineous.....................15
Posterior femora in part black.......................................16

15. Abdomen wholly ferruginous.............................**frigidus** *MacG.*
Abdoman in part black. ♂.—Black, with the following parts whitish: the clypeus, cheeks, a fine line on the latero-caudal margin of the pronotum, the tegulæ, a spot on the pleuræ, a spot on the pectus, a spot above the posterior coxæ, the sides of the basal plates, a line on their posterior margin, and the anterior coxæ; the legs, including the coxæ, shading from luteous to rufous except a spot on the trochanters, the base of the femora above, a black line on the apex of the posterior tibiæ above, and the posterior tarsi; the abdomen, including the venter, rufous, except a transverse spot on the base of the first segment and the apical segments; the clypeus deeply and squarely emarginate; the third segment of the antennæ one-third longer than the fourth; the wings hyaline, yellowish along the veins; the veins brownish; the costa and stigma black. Length, 11 mm. Habitat.—Olympia, Washington (Trevor Kincaid)....................... ....**pallipectis,** sp. nov.

16. Four anterior femora wholly pale. ♀.—Black, with the following parts yellow: the clypeus, the labrum, the mandibles except at tip, the cheeks, the face beneath the antennæ, a spot above the base of each antennæ, the collar, the tegulæ, the ventral margin of the pronotum, an angular mark on the pleuræ, a spot above the posterior coxæ, the pectus at middle behind, the coxæ except the base of the posterior pair, the trochanters and the base of the femora; the following parts rufous: the front and middle legs slightly beyond the middle of the femora, the middle of the posterior femora, the basal three-fourths of the posterior tibiæ, and the abdomen beyond the basal plates except the saw-guides; the posterior femora and tibiæ black at apex; the wings luteous; the veins brown; the costa and stigma luteous except the apex of the stigma. Length, 11.5 mm. Habitat.—Mt. Washington, N. H. (Mrs. Annie Trumbull Slosson).....................**pallicolus,** sp. nov.
Four anterior femora with a black line above. ♂.—Yellow, with the following parts black: the antennæ, the head except an ovate spot above the base of each antennæ, the basal two thirds of the cheeks, the clypeus, the labrum, the

base of the mandibles, a spot on the pronotum, deeply angulate beneath, the mesothorax and the metathorax except the scutellum, a spot on the pleuræ, the pectus, a spot above the posterior coxæ, the basal one-half of the basal plates, a line on the base of the first abdominal segment, and a spot on the apex of the femora; with the following parts rufous: the apical segments of the abdomen, the apex of the posterior tibiæ and the posterior tarsi; the clypeus squarely emarginate; the third segment of the antennæ twice the length of the fourth; the wings yellowish hyaline; the veins blackish; the the costa and the base of the stigma luteous; the apex of the stigma brownish. Length, 11 mm. Habitat.—Olympia, Washington (Trevor Kincaid.) **magnatus**, sp. nov.

17. Posterior tibiæ black. ♂.—Black, with the following parts yellowish white: the clypeus, the labrum, the mandibles except at apex, the cheeks, an interrupted line on the pleuræ, a line on the collar, a spot on the tegulæ, a spot above the posterior coxæ, the sides of the basal plates, a spot on the pectus, the coxæ, the trochanters, the femora except a black line above, the front and middle tibiæ beneath, the venter, and a narrow margin on the apex of the second and third abdominal segments; the clypeus narrowly and squarely emarginate; the third segment of the antennæ one-third longer than the fourth; the wings hyaline, the apical third smoky; the veins, including the costa and the stigma, black. Length, 13 mm. Habitat.—Olympia, Washington (Trevor Kincaid)........................ **nigritibiales**, sp. nov.

Posterior tibiæ in part pale above.................................. 18

18. Four anterior tibiæ entirely pale.......................................19

Four anterior tibiæ with a black line above. ♂.—Black, with the following parts yellowish-white: the clypeus, the labrum, the mandibles except at apex, the cheeks for two-thirds the length of the eye, the palpi, the tegulæ, a broad mark on the collar, an oblique spot on the pleuræ, a spot on the pectus, a spot above the posterior coxæ, the sides of the basal plates, the coxæ and the trochanters except a black line above, the front and middle femora, the tibiæ and the tarsi except a black line above, and the posterior femora (becoming rufous towards the apex) except a black line above; the following parts rufous: the posterior femora and tibiæ and the abdomen beyond the basal plates; the clypeus squarely emarginate; the third segment of the antennæ twice the length of the fourth; the wings hyaline; the veins black; the costa and the stigma luteous, darker at their juncture. Length, 10.5 mm. Habitat—Olympia, Washington (Trevor Kincaid). This species has been sent to some correspondents under the name *rubelloides* .... **messica**, sp. nov.

19. Collar pale...20

Collar black. ♂.—Black, with the following parts yellow: the clypeus, the labrum, the mandibles except at tip, the cheeks, the tegulæ, a spot on the posterior part of the mesopleuræ, a spot above the posterior coxæ, a vertical line beneath the posterior wings, the sides of the basal plates, the basal membrane, and the coxæ, trochanters, and front tibiæ except a black line above; the following parts rufous: the abdomen, including the venter beyond the basal plates, the middle and posterior femora except a black line above, the

tibiæ and the tarsi; the head and thorax densely and finely punctulate; the wings luteous; the veins, including the costa and stigma, black; the third segment of the antennæ twice as long as the fourth; the clypeus squarely emarginate. Length, 12 mm. Habitat.—Seattle, Washington (S. Bethel). **stigmatus**, sp. nov.

20. Pleuræ and pectus marked with rufous.................. **ventricus** *MacG.*

Pleuræ and pectus marked with yellow. ♂.—Black, with the following parts yellow: the clypeus, the labrum, the mandibles except at apex, the cheeks, the tegulæ, a spot on the collar, a spot above the anterior coxæ, the prosternum, the pectus, an angulate mark on each pleura, the coxæ and trochanters beneath, the front and middle femora beneath, the front tibiæ beneath, the suture between the mesothorax and the metathorax, a spot above the posterior coxæ, a spot on each side of the basal plates, and a fine line on the caudal margin of the basal plates; the following parts rufous: the posterior femora, the middle and posterior tibiæ, the front and middle tarsi (the posterior tarsi are black), and the abdomen beyond the middle of the first segment; the clypeus roundly emarginate; the third segment of the antennæ one-fourth longer than the fourth; the wings hyaline; the veins brown; the costa and the stigma luteous. Length, 12 mm. Habitat.—Plattsburg, New York (H. G. Dyar).. **hyalinus**, sp. nov.

21. Four anterior femora and tibiæ black above. ♀.—Black, with the following parts yellow: the clypeus, the labrum, the mandibles except at apex, the cheeks, two spots above the base of the antennæ, the tegulæ, the collar, a line on the pleuræ, the ventral part of the pronotum, a vertical line beneath the posterior wings, a spot above the posterior coxæ, a spot along the lateral margin of the coxæ at apex, the legs beyond the coxæ except above, a longitudinal band along each side of the abdomen, and the caudal margin of the ventral segments; the wings slightly infuscated; the veins and the stigma black, the stigma some paler at base; the third segment of the antennæ twice the length of the fourth; the clypeus squarely emarginate. Length, 9 mm. Habitat.—Colorado (Carl F. Baker)................ **lateralbus**, sp. nov.

Four anterior femora and tibiæ rufous. ♀.—Black, with the following parts yellowish: the clypeus, the labrum, the mandibles except at apex, the collar, the tegulæ, a line on the pleuræ, a spot above the posterior coxæ, the sides of the basal plates, the coxæ and trochanters except a black line above, and the front femora, tibiæ, and tarsi beneath; the following parts rufous: the front femora above except a black spot at apex, the front tibiæ and tarsi above, the the middle and the posterior legs beyond the trochanters except a black spot at the base of the femora above, a spot on the apex of the second and third abdominal segments, and the following segments, including the venter; the clypeus deeply emarginate; the third segment of the antennæ one-third longer than the fourth; the wings hyaline, the veins black; the costa luteous; the stigma brownish. Length, 10 mm. Habitat.—Olympia, Washington, (Trevor Kincaid).............................. **capitatus**, sp. nov.

NOTES ON THE TRANSFORMATIONS OF HIGHER HYMENOPTERA.—III.

BY A. S. PACKARD.

Megachile (possibly **centuncularis** *Linn.*).

Larva.—Head of the usual proportions, of good size compared with the rest of the body. Eye-pieces prominent, full and convex. Towards but below the vertex, in between the eye-pieces, is a depressed subcordate area, with a subacute depressed tubercle on each side of the median line, which may be the antennæ; between this area and the clypeus is a transverse raised portion; on each side of this ridge and aligned with the side of the labrum at its base is a minute corneous tubercle, which may be the antennæ, though I think not.

The clypeus is considerably shorter than broad; its base is a little subacutely produced onesidedly, the front edge deeply excavated; the surface is not convex and increases in width towards the anterior edge. The labrum is broadly subtrapezoidal, twice as broad as long; base rounded, semi-circular; anterior edge rather deeply excavated, rendering it slightly bilobate. Mandibles slender, not narrowing much towards the end, which is unequally bidentate, the inner tooth the smaller; they are much broader, stouter and thicker at the end than in *Andrena.*

The maxillæ are long and slender, acutely pointed at the tip on one side, the inner lobe being produced and incurved, while the outer acute lobe or tubercle is minute; this is easily overlooked and more remote from the other lobe than usual; they are long enough to touch each other. The labium is long, square at the end, corneous; below and posterior to this square corneous or chitinous edge are two minute acute spines on each side of the labium, which are probably the rudimentary labial palpi.

The body is thickest towards the posterior end, on the terminal fifth of the body, whereas in *Andrena* it is thickest at about the middle; towards this last fifth the body gradually increases in thickness, and then suddenly rounds off, so that the end is much rounder, more obtuse than in *Andrena* and the larva of Apidæ in general. The penultimate sternite is larger and broader than in *Andrena*, while the last sternite is smaller; differences readily appreciable. On the whole the larva of *Megachile* resembles that of *Bombus* more than that of *Andrena.*

As regards the head characters, the larval *Megachile* differs from the

larva of *Andrena* in its head being a little larger, the antennal tubercles being flatter and much less prominent; the eye-pieces less globose and spreading less laterally. The clypeus is longer and larger, and the front edge deeply excavated, where in *Andrena* it is square and entire. The labrum is narrower, the front edge more excavated, being hardly at all so in *Andrena*. The mandibles are stouter; the maxilla large and slender, as is the labrum, which has a broad, thickened, square chitinous tip, not present in *Andrena*, the end of which in *Andrena* is fleshy.

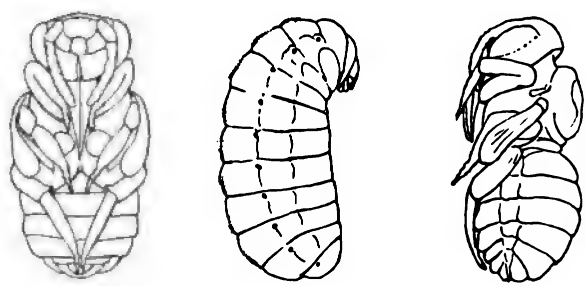

Fig. 9. *Megachile centuncularis*. *a*, larva; *b*, *c*, pupa. (Emerton, *del.*)

Pupa.—Head broad and flat, subtriangular, the front flattened; the supraantennal area broad and flat; seen laterally the head is much more vertical than in *Bombus*, and is more like *Apis*; seen from above the head is much broader, supraclypeal piece transversely oblong-triangular, thus setting the antennæ far apart. Clypeus transverse, broader than long, with two curvilinear lateral lobes which are much longer and more curved than in *Bombus*. Labrum square, longer than broad, the edges square, the sides contracting slightly towards the anterior edge, which is square, not rounded or excavated. Mandibles long, stout, thick, not incurved, but rather bent inwards so as to meet just in front of the labrum. The eyes are more prominent and farther apart than in *Bombus*. Antennæ more rectangularly bent than in *Bombus* owing to the greater width of the head; the joints are shorter, much more convex; only reaching to just beyond the middle of the anterior tarsi, whereas in *Bombus* they reach to the second joint of the posterior tarsi. The maxillæ reach just beyond the anterior tarsi; neither pair of palpi are visible. Paraglossæ extending to half-way between tips of lingua and the maxillæ. The mouth parts are less loosely arranged on the breast than in *Rhopalum*, *Pelopæus* and the other fossorial forms.

The legs are very short compared with those of *Bombus*, only the last pair meeting, the terminal joints of the tarsi folded together and lying contiguous to each other; tarsi much shorter and thicker than in *Bombus*.

Abdomen broader and squarer, more truncated at tip than in *Bombus*, the terminal urites as in *Bombus*; the rhabdites nearly retracted, forming a pair of papillæ which are rounded and thick.

The body is less curved on itself and the prothorax shorter. The mesoscutellum is less prominent and convex, while the abdomen is longer and narrower; the segments more thickened at the end, and spined more prominently.

The tegulæ are, as in *Bombus*, divided into an anterior flattened area, on the side of which, just above the pleurites, are the spiracles, and a posterior raised thickened area on the posterior half of the segment, which is much flatter, less ridged and convex than in *Andrena*, resembling *Bombus* more in this respect; this flattened ridge widens more towards the pleurites. The pleural region with elevated thickened tubercles, a separate knob on each segment. The ridges on the tergites and pleurites are no more distinctly marked on the prothorax than elsewhere, and not, in fact, so much as on the abdomen. Beneath the sternites are a little more ridged, more convex than in *Andrena*. The whole surface above and beneath is covered with minute hairs, which are absent in *Andrena*.

The pupa can at once be distinguished from that of *Andrena* by the prothoracic segment not being thickened any more and not quite so much as the abdominal ones, by the head being a little larger, and by the body not so rapidly tapering towards the head, and being thickest on the posterior one-fifth.

In all these characters *Megachile* closely approaches *Bombus*. In the head-characters it closely resembles *Bombus*; the clypeus, however, is not so small and distinct, and the labrum is a little larger, and less distinctly bilobate, while also the supraclypeal area is quite different, not being so triangularly depressed; posteriorly the shape is much the same. The labrum differs in the tips being rounded, fleshy, and with a terminal lunate area. The maxillæ are more acute, terminating in longer spines. The body is broader and flatter, the pleural region a little more prominent, and the terminal segment quite different, the tergite being much smaller than the sternite, which is very different from that of *Bombus*. *Megachile* does not have the minute thoracic tubercles ending in minute spines present in *Bombus*; the thickenings of the rings posteriorly are more marked in *Megachile* than in *Bombus*, and the body is more hirsute.

Ceratina dupla *Say.*

Larva.—The following description was drawn up from living specimens.

Head rather long and narrow, as in *Megachile*; full and convex; the vertex elevated convex, with fine hairs; front scarcely so broad as in *Megachile*. Clypeus full, convex. Labrum exserted, square, thick and very prominent; end much thickened, excavated beneath. Mandibles as in *Megachile*, long and thick, suddenly bent in under the labrum, so that the tips are not visible. Antennæ rather thick, bent at a considerable angle on the side of the clypeus; the scape longer and slenderer than in *Megachile*, the flagellum a little clavate, the tips reaching to the end of the maxillary palpi, or near the tips of the first tarsal joint when the leg is normally folded. Ocelli similar to those of *Megachile*, forming raised, acute papillæ; the maxillæ are nearly twice as long as in *Megachile*, reaching to the middle of the body and to the second pair of trochanters. The palpi three-jointed, rapidly tapering toward the tip; the basal joint much the largest. Labial palpi two-jointed, reaching to the tip of the second pair of legs; lingua long and slender, like that of *Bombus* in length, reaching to the

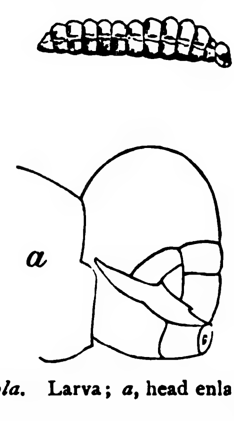

Fig. 10. *Ceratina dupla.* Larva; *a*, head enlarged. (Trouvelot, *del.*)

tip of the second abdominal segment. The legs much slenderer than in *Megachile*, the tarsal joints especially slenderer and longer than in *Megachile*, and reaching the same relative distances toward the tip of the body. In the median line of each of the second to the fifth abdominal segments is an acute spine, the hind tarsal joints lying on each side of and parallel with them; these spines I have not before noticed. The last sternite is full and large, rounded triangular. The ovipositor

is exserted, the rhabdites, as usual, forming a square tip. The thorax above is much as in *Megachile*, but the abdomen is more contracted at base, and a little more acutely produced at tip, but otherwise much as in *Megachile*; the edges of the abdominal segments are posteriorly much thickened and minutely dentate. Length, .30 inch.

It differs from *Megachile* in its longer, narrower head, narrower full clypeus, the shorter, squarer labrum, the long lingua and maxillæ, the latter being nearly twice as long as in *Megachile*, also in the presence of the four acute spines along the under side of the abdomen, as well as in the longer, slenderer legs and the narrower base of the abdomen.

Xylocopa virginica (*Drury*).

Larva.—Received July 8 from M. James Angus, of West Farms, N. Y.

Length, 1 inch; thickness, .28 inch. Larva nearly full grown. The head is very small, and the jaws move rapidly, being thrust out back and forth from beneath the labrum, which is very movable. Body cylindrical and tapering to a point, so as to be very much alike at both ends. The usual lateral swollen area is very faintly marked, rendering the body still more cylindrical than usual. The segments of the body are quite convex, the sutures being rather deeply impressed, but they are not tuberculated above, though somewhat thickened on the hinder edge.

The larva is much like that of *Bombus*, but slenderer and tapering more towards each end.

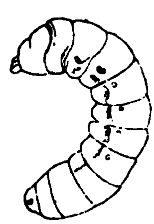

Fig. 11. *Xylocopa virginica*. Larva natural size. (Emerton, *del.*)

Anthrax sinuosa *Wiedermann*.

Larva.—We received July 8, 1867, from Mr. James Angus, the larva of this species (see Guide to Study of Insects, 397), but have not published the following description: Body smooth, flattened, slowly tapering towards each end, so that it is difficult to tell which is the head or tail end. The head is oblong, with the jaws on the under side, re-

tracted. The segments above not very convex, though the sutures are very distinct and well impressed. Laterally they dilate into a large subacute tubercle. The end of the body is smooth, rounded, subacute. There are no hairs. Color dusky, white on the head and end of the body. Length of body, .20; width, .05 inch.

Bombus fervidus.

Nesting-habits, Larva and Pupa.—The nest and young of this species, together with the bees, were found by Mr. F. W. Putnam, at Bridport, Vt., August 5, 1863. The nest occurred with several others under the grass in deserted mice nests. There were only three imago bees in the nest, as it was collected at noon time when the rest of the colony was out. One bee, however, left its cell soon after the brood was collected.*

All the workers, sixty-five in number, had escaped from their cells and deserted the nest, the brood-cells having had their upper third irregularly eaten away. The bodies of four or five workers remained in certain cells in which they had died. I have never found any traces of ichneumon parasites in any *Bombus* nest.

Dimorphic Forms.—The colony also contained 13 males, 5 small and 8 large individuals; also 9 queens, of which 3 were small and 6 large. The measurements were as follows:

Average length of 4 workers with the hair all grown, .55 in.; breadth, .35 in.

Average length of 3 females, with the hairs just beginning to grow, .62; breadth, .38 in.

Average length of 6 females, naked and white, .67; breadth, .43 in.

Average length of 5 males, dark and hairy, .52; breadth, .30 in.

Average length of 8 males, naked and white, .55; breadth, .33 in.

From this it will be seen that there are two sizes of males and two of females, among bumble bees. Whether this holds good for the workers must be proved by further observations.

In the two sets of males and females there was as much variation in length between the individuals as between the two sizes taken collectively. The difference in size between the smallest males and females was .10 inch, and the difference in size between those of the larger set was from .01 to .12 inch; the difference in size between the smallest male and the largest female was .25, being .3 more than one-half the length of the smallest male.

* Also see notes on the habits of some species of bumble bees, by F. W. Putnam. Proc. Essex Institute, IV, October, 1864, 98–104.

Of the first brood of males and females the latter were not nearly so dark and hairy as the males, which were just ready to leave their cells, except one which was a subimago.

I first observed this dimorphism in the pupæ taken from this nest; it was better seen than in examining the adult bees.

The eggs are elongated cylindrical, with the ends truncated and rounded off; and they are slightly curved in themselves.

Larva of Worker.—In their general form the larvæ of *Bombus* agree closely with those of *Apis* and *Megachile*. In outline lunoid the body is thick, cylindrical, though a little flattened, and the rings rapidly diminish in width towards each end of the body. In their natural attitude the larvæ when in their cells are doubled upon themselves, so that the under side of the head is closely oppressed to the tip of the abdomen. The enlarged pleural surface, which forms a raised lateral ridge, aids in giving the flattened appearance to the body. On the hinder half of each ring of the body is a tergal raised, flattened band proceeding on each side from the lateral ridge, leaving a transverse depressed ovate lanceolate area, at each end of which is a spiracle. There are ten spiracles, one for each thoracic ring and one on each of the first seven abdominal rings.

Beneath the body is flattened, and the sternal region is very distinct from the raised pleuræ. Each ring has its surface raised into two transverse ridges.

Above, the thoracic rings differ from the abdominal ones in having the raised portions cover nearly the whole surface, which actually takes place in the prothoracic ring. It is on this raised portion that the minute horny acute papillæ are situated; two for each second and third ring, and three on the middle of the prothoracic ring in a transverse line. The arrangement of these tubercles does not essentially vary in the different species. The prothoracic ring is a third narrower than in the metathoracic ring, though as long. The tenth and abdominal ring is in outline equal in size to that of the head, being orbicular when seen from behind. Its surface is marked below by an oblong square raised mesial portion, twice as long as broad. There is no anal outlet since the intestine is a blind sac. The ♀ and ☿ genitals can be distinctly seen, so that the sexes of the larvæ can be easily distinguished.

Of the two pairs of stylets on the ninth ring, the most basal and outer are triangular, and the inner sides nearly meet over the mesial line of the body. The smaller outer and more remote pair have their greatest length across the ring; their tips nearly meet on the mesial line of the

body and near the tips of the middle pair of stylets. The pair of the eighth ring is later developed. They appear first as two oval rings remote from the middle, and larger axes at right angles to body. Early in the semipupa stage, when they first appear as two slender elongated stylets, lying across the eighth ring, with square bases facing each other on each side of the mesial line of the body, while the ends look outward towards either side of the body, at this time the mesial pair or true ovipositer on the ninth ring is long and slender, while the outer pair have only their triangular tips developed, which slightly converge toward tips of second pair.

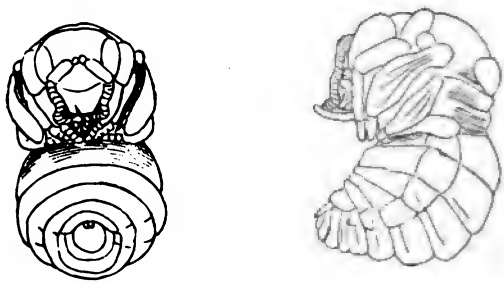

Fig. 12. *Bombus fervidus.* Pupa.

Bombus vagans.

Nesting-habits, Larva and Pupa.—In the empty cells there were no larvæ or eggs to be found. In the bottom the sides a little way up were covered with a thin layer of meal or pollen which had been placed in them by the queen, and this thin layer of refuse left had been pressed to the side of the cell by the body of the fully-fed larva which had rejected it. In one empty cell there was a considerable quantity of pollen, which was exceedingly fine, and under high powers presented a spherical shape, the surface being thickly punctured.

In the twelve workers there was no remarkable variation in size, such as was observed in another colony of pinned bees, undoubtedly of the same species. The single male was of the same size as the worker; it slightly exceeded some workers in size, but was smaller than some others; among a set of alcoholic specimens it could not at first glance be distinguished from the workers; there is no difference in the length of the maxillæ or of the labial appendages.

From the nest which Mr. Putnam found in an old stump under a barn, August 15, he took only fifteen adult bees, viz., one male, two females and twelve workers; but the number of bees then constituting the

colony could be estimated by counting the empty cells. These were wanting in the upper third, or rarely the upper half, which had been eaten away by the bees to allow the occupants to escape; the edges being rough and irregular. Some of the cells were nearly all gone, three-fourths of some of them having been removed; these were situated on the sides of or nearly beneath the bunches of small cells which surrounded the single female or queen cell.

At this date there were 58 empty cells, hence the colony, if all were alive, was of course composed of that number of individuals; of these all were workers except a single male and two females.

Larva.—The larvæ are easily distinguished from those of *B. fervidus* and *B. separatus*, which is the more unexpected, since the two last named species agree so closely after the specimens compared have been in alcohol. The head is considerably smaller, nearly one-fourth so, than in *fervidus*, while the transverse raised bands across each ring are much thicker, and the lateral raised pleural lines are much more prominent than in *B. fervidus*, thus making the under side of the body appear flatter and the upper side more convex than in *fervidus*. The whole body is more lunate, compact and blunter at the extremity than in *fervidus*. Such are the differences in comparing twenty larvæ with an equal number of those of *fervidus*. Whether these differences are constant, and have been stated correctly, future study will prove. The sizes of the different stages of growth correspond very exactly with those of the equivalent stages in *fervidus*.

Eggs.—The eggs of this and all the species when compared do not differ, and if they were all intermingled, the species could not be picked out.

Pupa.—Comparing some (eight) ♂ semipupæ with an equal number of ♀ semipupæ of *B. fervidus*, there are no differences, not even in the tip of the abdomen.

Compared with the male of *fervidus* it is very considerably smaller and slenderer, the abdomen being sensibly more produced towards the more acute tip and the limbs are throughout more slender. The head is shorter and broader. The second joint of the antennæ is longer, passing beyond the eyes, where in *fervidus* they do pass beyond the lower angle and outer edge of the eyes. The maxillæ and lingua are shorter than in *fervidus*, being just as described in the worker pupæ of *B. separatus*, and are unitedly narrow, as in the last named species. The limbs are no longer, but all the joints are considerably narrower than in *fervidus*. Here, as in the other sex, the genital armature does

not differ materially in the two species compared. Perhaps the lateral pair of stylets are shorter, while the inner mesial parallel stylets are a little longer, though these differences are only adopted provisionally. Length of ♂, .44; width, .24 inch.

Both the ♀ and ☿ are of the same size (the latter only .02–.03 less) and agree much more closely with the same states in *fervidus* than does the ♂. Still, however, the body and limbs are a little more slender, the mouth parts are shorter, and the head broader than in *fervidus*.

Average length of worker pupa .43; breadth .23 inch.

Average length of female pupa .58; breadth .28 inch.

One under-sized individual is .32 × .18.

Bombus separatus *Cresson.*

Nest, Larva and Pupa.—This nest was found by Prof. Putnam, July 23d, under the grass, in a deserted field-mouse's nest, in a rather damp situation. The active members of the colony were ten bees (no males among them), which were captured and pinned. On examining the nest I found that it consisted of 36 cells, of which all but 23 contained females and workers; of the remaining 13, which were all worker cells, two contained pollen (or honey) closely packed; the rest were empty and with the tops eaten off. The other 23 contained one worker in the semipupa stage, ten worker larvæ, one female larva, five semipupal females and four female pupæ. There were also 20 eggs and 12 young larvæ in the masses of bee head which were found attached to the sides or top of the queen cells, as shown in Fig. 13. When placed on the top of a cell the bee head formed a rounded mass, which, on be-

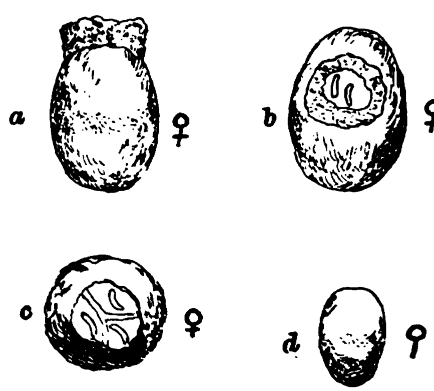

FIG. 13.—*Bombus separatus.* *a*, cell with mass of pollen on top; *b*, one with pollen enclosing two eggs; *c*, view from above; *d*, worker cell. (Author *del.*)

ing opened, disclosed four partitions, two at each end of the slightly ellipsoidal area, with two at each side; the two lateral ones being widely separated, but the other two only separated by a thin partition. These are walled in by the queen bee after she has placed one or two eggs in each cell. Out of this mass of food the young larvæ when hatched begin by eating the food to gradually construct their cells in the manner observed and described by Professor Putnam. One would suppose that there would be one larva only in each compartment, but on the contrary I found two young larvæ in each. The eggs are the same as those of *B. fervidus*, no specific differences being discernible.

The larvæ were young, none being more that one-third the size of the workers in the semipupa stage, while the single female larva was of full size.

The young larvæ compared with those of B. fervidus.—They are so similar that it would be impossible to distinguish them. The larvæ of *B. fervidus* differ more among themselves than do those of *B. separatus* and *B. fervidus ?* The size of the head and proportions of the body, are the same. The thickened portions of the segments are also much the same, though there is a difference in that this portion is a little thicker in *B. fervidus*, but this is not a constant character. Indeed, in comparing two larvæ of the two species mentioned, each nearly a quarter of an inch long, I can see no difference between them.

Pupa of Worker.—It can best be described by comparing it with that of *B. fervidus*, of which I had the greatest number of specimens. Besides being a little smaller, it differs in form, being more plump, nearly a line shorter, and slightly broader. The head is more triangular, being shorter and at the same time proportionately broader. The eyes converge slightly towards the mouth. The antennæ and clypeus and labrum, as well as the ocelli, show no appreciable differences.

The genital armature and tip of the abdomen in general do not, contrary to our expectation, afford good specific distinctions. We see, therefore, that the pupæ differ specifically in their size and proportions, while the perfect bees have added the more readily recognized differences in coloration and hairiness.

Of the ten worker pupæ two were a little larger, almost in the subimaginal stage, and dark, and belonging apparently to the second brood of workers.

Average length of 2 worker pupæ of the first brood, .50; breadth, .32 inch.

Average length of 8 worker pupæ of the second brood, .46; breadth, .28 inch.

Female Pupa.—The pupæ of the females are equal in size to that of

the largest *B. fervidus*, and the female pupæ differ in the same characters as already given for the worker pupæ. In this species, as in all other bees and wasps, the only external difference between the workers and females is that of size.

The female pupæ were all of one and the same size, white and naked.

Apis mellifica *Linn.*

Larva of Worker.—I am not aware that a careful and comparative description of the larval honey-bee worker has been published. The following descriptive comparisons have been made with larva of the bumble bee:

Closely resembles larva of *Bombus*, but the body is shorter, broader, flatter, with the head less prominent than in *Bombus*. The body is much rounded towards the head and abdomen, tapering very equally at both ends; the segments but slightly convex, while the lateral region is less prominent than in *Bombus*, less so than usual; and the posterior portion of the segments is less thickened than usual. On the anterior part of the back (tergum) of each ring is a broad sublunate area, behind which, and especially on the sides, the ring becomes more convex. The tip of the abdomen is subelliptical, being round, but longer than broad; the tergites and sternites not well marked. It, however, resembles the larval *Bombus* quite closely. Genitals well marked on eighth ring at front edge, appearing as two minute parallel slender tubercles, also a pair on the ninth and tenth segments less distinctly marked, but a little larger. The head is of about the same proportion to the rest of the body as in *Bombus*; it is a little longer than broad, the front not very convex. Eye-ring not very full. The median line between the eyes is deeply impressed. The antennæ each form a deeply depressed minute tubercle on each side of the base of the clypeus. Supraclypeal area indistinctly marked. The clypeus is square, as long as broad, much longer and narrower than in *Bombus*. The labrum is broad, bilobate, covering the ends of the mandibles; broader and more transverse than in *Bombus*. The maxillæ are rather slenderer than usual, subacute, ending in a minute acute spine. Labrum as usual, ending in a slightly chitinous transverse ridge. Mandibles cylindrical, acute, ending in a single point, more fleshy, and more like the maxillæ than usual.

Position of Larva.—It is doubled on itself in the bottom of the cell, being more doubled than in *Bombus*, and with a softer, thinner skin. The cell of the semipupa is closed over, and the body of the latter is elongated and extended along the length of the cell. There is nothing in the shape of the larva to justify the inference that *Apis* is not a higher genus, more specialized, than *Bombus*.

ON THE WHITE EUCLEIDÆ AND THE LARVA OF CALYBIA SLOSSONIÆ (*PACKARD*).

PLATE V.

BY HARRISON G. DYAR, A. M., PH. D.

There are in Europe and Asia a number of moths colored white or nearly so, belonging to the family Hypogymnidæ (Lymantriidæ=Liparidæ). In the earlier days of the description of American species, several kinds were found superficially resembling them, which were therefore described as Liparidæ and are still listed so in Kirby's catalogue, though really presenting fundamental differences. However, as early as 1882, Dewitz showed that one of the larger species was a Eucleid from an examination of a cocoon, and, some ten years later, Packard was led to the same conclusion in describing one of the smaller species which Mrs. Slosson had then just discovered in Florida.

The species are all subtropical, inhabiting regions where not much entomological work is being done; but fortunately one of them extends into our country and I was able to discover the larva, the characters of which confirm the opinions of Dewitz and Packard. They are here presented at length.

I have examined Grote's types of *Phyrne immaculata* and *Euproctis pygmæa*, sent me by Dr. Skinner. There is no question but that the former is Packard's *Eupœya nivalis*. Grote's type bears the cocoon and number 229. This particular specimen was not sent me, but Dr. Skinner states that it is a female, which accounts for the non-pectinated antennæ. Two specimens with the same labels "Cuba" and "Dr. Wilson" were sent.

Genus **Calybia** *Kirby*.

1865.—*Phyrne*, Grote, Proc. Ent. Soc. Phil. V, 246 (preoc. Rept. 1843).
1892.—*Calybia*, Kirby, Cat. Lep. Het. I, 446.
1893.—*Eupœya*, Packard, Ent. News, IV, 169.

Synopsis of Species.

Under side of primaries entirely white.................... **immaculata** *Grote*.
Under side of primaries partly gray, especially along costa.
  Secondaries white above.
    Primaries white above.
      An inconspicuous yellowish dot near anal angle in male.
slossoniæ *Pack*.

A distinct zigzag yellow-brown mark above anal angle.
pygmæa *Grote.*
A subterminal smoky band on primaries................**fumosa** *Grote.*
Secondaries gray above...........................**jamaicensis** *Schaus.*

Genus **Leucophobetron**, nov.

There are two species which differ from *Calybia* in the much larger size (25 to 35 mm.) and the divergent tufts at the tip of the abdomen in the male, both described as Liparidæ. Dewitz has shown (N. Act. K. Leop. Deut. Akad. Nat. xliv, 252) that one of them is a *Eucleid* and it is probable that the other is also. The first is *L. argentiflua* * Geyer (Samml. Exot. Schmett, iii, pl. 18, 1836), from Cuba; the second is *L. argyrorrhœa* Hübn. (Zuträge Exot. Schmett., ii, Figs. 245, 246, 1823). For convenience I would separate them from *Euproctis* and *Eupæya* under the above term.

Synopsis of Species.

Wings with a large dark spot above anal angle................**argentiflua** *Gey.*
Wings white, immaculate............................**argyrorrhœa** *Hübn.*

Calybia slossoniæ (*Packard*).

1893.—Packard, Ent. News, IV, 169.
1894.—Neumœgen & Dyar, Journ. N. Y. Ent. Soc. II, 111.
1895.—Dyar, Can. Ent. XXVII, 15.
1895.—Dyar, Can. Ent. XXVII, 245.

LARVA.

1897.—Dyar, Can. Ent. XXIX, 68.
1897.—Dyar, Journ. N. Y. Ent. Soc. V, 100.

SPECIAL STRUCTURAL CHARACTERS.

Outline elliptical, more narrowly so if the appendages are excluded; dorsal space broad, even, flat; lateral space broad, sloping, rounded; subventral space rather broad, continuous with the lateral space, not retracted. Ridges practically absent, the subdorsal indicated by the change in slope between back and sides. Tubercles greatly modified, as in Phobetron. In stage I a subdorsal row of single spines with enlarged bases, two on joints 3 and 13; lateral spines obsolete, represented by obscure papillæ; subventral setæ large and distinct. Ultimately the subdorsal warts are attached narrowly, but with very broad bases, encroaching on the dorsal and lateral spaces and produced later-

* Mr. W. F. Kirby has very kindly examined Hübner's works for this species and has sent me the above correction to the reference in his catalogue.

ally into fleshy appendages of nearly equal length, the anterior ones a little shorter. These appendages are constricted at about the centre of attachment, the basal portion forming an elevated heart-shaped piece, bearing seta i above, the terminal part forming a tapering horn with seta ii at the apex. The lateral row of warts are rudimentary, consisting of small, naked finger-shaped papillæ, hardly larger than the spiracles. The subdorsal horns may be detached, but less readily than in *Phobetron*, and they leave a slight scar, from which a very little fluid exudes. The appendages are situated on joints 3 to 13, one more than in *Phobetron*, and are directed downward so as touch the leaf and cover the sides. The warts bear long, finely feathery fringe-hairs with smooth bases, other short smooth hairs, short club-shaped feathered hairs and the primitive setæ i and ii. The skin is covered with a rather dense coating of fine, short, pale hairs from large colorless tubercles. No depressed spaces seen; the skin is hollowed laterally, but in an ill-defined manner. The warts are not shed on forming the cocoon. There are no stinging spines.

This interesting larva is colored to escape observation. The adaptation is the same as is *Sisyrosea textula*, but derived from a phylogenetically dissimilar stock. The fringing horns consist of the subdorsal instead of the lateral series and the fringe hairs are feathered secondary setæ instead of degenerated stinging spines.

AFFINITIES, HABITS, ETC.

The only close ally of this larva among our species is *Phobetron*, and, quite unexpectedly, it is a very close ally. Dr. Packard, judging from the moth, was of the opinion that it was not allied to *Phobetron*, placing it near *Heterogenea*. I placed it still further away, in the Megalopygidæ. The larva has all the essential characters of *Phobetron*, even in some detail. The adaptation being different, the superficial appearance is different, resembling *Sisyrosea* rather closely, but it really has no near affinity with the spiny Eucleids. From *Phobetron* it differs as follows: (1) the middle tubercle of joint 4 is absent; (2) the lateral tubercles are reduced to insignificant papillæ instead of existing as small warts; (3) the subdorsal horns are all of the same length, the weak segments of stage I appearing only in the coloration in certain examples, which lack the red tips on the horns that are short in *Phobetron*; (4) there is a horn on joint 3 instead of a small wart; (5) the color is green instead of brown, with a thinner hair coating. The larva is more specialized than *Phobetron* on the whole. In the equal length

of the horns it would be lower, except that this character may not be primary. The hairs are also less specialized.

The allies of our *Calybia* are in the West Indies and on the South American coast, as seen by the species reviewed above. *C. slossoniæ* is the Floridian representative of *C. pygmæa* Grote from Cuba, differing from it in the smaller size of the mark at the anal angle. My male specimens all possess a small but evident yellowish mark in this location. In the females it is absent.

During the winter season the cocoons of *C. slossoniæ* may be found more or less commonly on the leaves or bark of the mangrove trees throughout southern Florida. The chalky white cocoons are very conspicuous on the green leaves, but on the whitish bark hard to detect. The white color of the moth seems to have the same protective value. It is remarkable why so many of the cocoons are spun upon the leaves, as if the instinct to seek the place for which the cocoon is adapted were lapsing. As the larvæ live on a plant which is always situated in water, they never leave it, even to spin. The moths emerge in about seven weeks, but scattering. The eggs are laid almost at once. They hatch in 15 days. The larvæ are solitary, resting on the under sides of the leaves; when young they eat little spots and channels through the lower epidermis, but at maturity the whole leaf is eaten as usual.

DETAILED DESCRIPTION OF CERTAIN STAGES.

Egg.—Elliptical, flat, somewhat irregular in size and shape, but never circular; translucent, pale yellow both on glass and leaves; 1.6×1.9, 1.4×1.2, etc. Laid singly. Reticulations rather prominent, quadrangular, irregular, distinct. The form of the developing embryo may be rather plainly seen (Plate V, Figs. 1 to 14).

Stage I.—Head retracted, joint 2 mostly exposed. Dorsum flat, the sides nearly perpendicular, rounded. A subdorsal row of spines, the basal portion enlarged next the body, tapering, ribbed; distal part stiff, dark. Arrangement as in Phobetron except for the absence of the lower spine on joint 4. Lateral spines reduced almost to obliteration (Plate V, Fig. 15). Segments 7, 9 and 11 weak, as shown by the horns leaning out. Pale yellowish, an irregular, geminate, brown dorsal line and a broader dark subdorsal shade below the subdorsal horns. Bases of the tubercles white. Length .75 mm.

Last Stage.—Elliptical, rather thick centrally, but pressed down at each end, fringed by the conical fleshy appendages (Plate V, Fig. 22). Anterior pair short, curved, the rest straight, of about equal

length after the fourth pair. Short haired above, fringed on the sides with long, soft, white hairs (Plate V, Fig. 20), which form a continuous, thought not very conspicuous fringe. At the base of the appendages, the fleshy, heart-shaped pieces rise above the dorsum and also above the base of the appendage, converting the dorsal area into a channel. They have short, rudimentary white hairs (Plate V, Fig. 21), besides seta i. Color light yellowish green, all the horns tipped with orange red, most so anteriorly. A blood red, diamond-shaped patch with whitish centre in the depressed dorsum on joints 4–5, 7, 9 and 11, four patches, the anterior one slightly elongate. Horns on joints 3 and 4 very faintly orange shaded. Sides hid by the horns, smooth, green. The traces of the lateral horns are seen with difficulty on removing the horns, as small whitish papillæ. Subventral setæ below the spiracles rather distinct. The horns arise about the centre of the segments from small depressions, and there is a smooth bulge of the skin below. The spiracle on joint 5 is in line with the others, but appears slightly unsymmetrical, rather higher on the fold in proportion. In the beginning of the stage the larva is all green, the dorsal marks appearing gradually. They vary somewhat in different examples. In another example the horns on joints 7, 9 and 11 were without the red tips. Lateral papillæ on joints 3, 4, 6 to 12.

Cocoon.—Rounded, elliptical, white, with streaks of brown without, brown within; the usual circular lid (Plate V, Fig. 24). In spinning, the larva elevates the horns and begins to spin silk around the base of its body. The cocoon is thus gradually built up, supported against the larva itself until finally the horns are enclosed. They do not become detached. The silk first formed dries white, making the white color of the cocoon, through which the brown appears in spots.

Food-plant.—Mangrove (*Rhizophora mangle*).

PARASITES.

Tachinid flies, which are usually such frequent parasites of Eucleid larvæ, seem to be absent in this case. This is doubtless due to the peculiar habitat of Calybia, for if the Tachinæ should infest these larvæ, the maggots would all perish at the time of pupation by falling in the water.

Two hymenopterous parasites infest the larvæ freely. One (*Pelecystoma eupæyæ* Ashm.) destroys the life of the larva while it is in the last stage. The host retains a life-like shape, but becomes bright red (Plate V, Fig. 23) and hardens. The parasite issues from a hole in

the empty larva skin, which remains adhering to the leaf, still presenting the appearance of the figure.

The second parasite (*Crypturus dyari* Ashm.) is even more abundant, infesting nearly half of the cocoons found. It shows no sign till the larva has spun, when, instead of the moth, the hymenopteron appears, eating a jagged hole in the cocoon, instead of emerging by the lid. The full grown larvæ of the insect may be found by opening the *Calybia* cocoons at the right time. It is flattened ventrally, dorsal segments arched, distinctly segmented, 13 segments including the head. A prominent substigmatal ridge along joints 5 to 12, just below the small spiracles, fluted by the incisures. The body is thickest at joints 7 and 8 and tapers each way to the rounded ends. Head small, membranous, rounded, smooth, somewhat bulging in the position of the imaginal eyes; no ocelli; antennæ represented by two tiny points; labium somewhat prominent, the only distinct organ, with folds or sutures marked faintly in brown. Color uniform whitish yellow, slightly shiny, rather opaque. Dorsal vessel less opaque, appearing darker, substigmatal ridge whitish. The skin surface, except on the head, is marked with very small rounded colorless granules, regularly spaced at about twice their own diameter from each other. The diameter is about .01 mm. Length of larva 6.5 mm., greatest width 3.3 mm., greatest thickness 2.5 mm.

Mr. Ashmead's description of these parasites has appeared in the Canadian Entomologist.

EXPLANATION OF PLATE V.

Fig. 1. Egg; unfertilized × 13.
" 2. Egg, segmenting, 30 hours.
" 3. Embryo, 50 hours.
4. Embryo, 60 hours.
5. Embryo, 100 hours.
7. Embryo, 5 days.
8. Embryo, 7 days.
9. Embryo, 8 days.
10. Embryo, 9 days.
11. Embryo, 10 days.
12. Embryo, 12 days.
13. Embryo, 14 days.
14. Embryo, 15 days.
Fig. 15. Larva, stage I (semidiagrammatic).
" 16. Subdorsal spine of stage I enlarged.
" 17. The same, not fully expanded.
" 18. Skin setæ of mature larva, enlarged.
" 19. A short, stiff hair.
" 20. A long, feathered hair.
" 21. Short, feathery or branched hair.
" 22. Mature larva × 4.
" 23. Parasitized larva.
" 24. Cocoon on a twig.
" 25. Moth of *Calybia slossoniæ*.

NOTES ON THE PUPA OF ŒTA FLORIDANA.

PLATE VI.

BY T. A. CHAPMAN, M. D.

Length, 13 millimeters; width, 2½ millimeters. Tolerably uniform width to the fourth abdominal segment, thence tapering finally to extremity.

Color.—Deep sepia, nearly black. A pale nankeen coloring in a broad dorsal stripe, along all the abdominal segments, extending outwards as far as the anterior trapezoidal tubercles, and having a narrow double line of the dark sepia or black color down its centre; traces of a similar coloring in a narrow supra and another infra-spiracular line.

The same color surrounds the marginal tubercles and at pitted markings in the situation of the third and fourth ventral prolegs.

Similar color on the front of the headpiece and a narrow line on each side of the prothorax and a broad patch in the centre of the mesothorax, ventral line of fifth and sixth abdominal segments also paler.

Dehiscence is by complete removal of front headpiece, by splitting down the back of the prothoracic segment and two-thirds of the mesothoracic.

The antennæ separate from wings two-thirds of the way down and slightly from leg cases which also open a little at anterior ends; they remain attached together below and also to wings; eye pieces remain in situ.

The two portions of prothorax somewhat separated from mesothorax, but attached by delicate membrane, and show fine radiating structure of first spiracle. (Plate VI, Fig. 3.)

Structure.—There is no posterior headpiece; the separated front piece is roughly hexagonal, the two sides being hollowed to receive the ends of the antennæ; and in the pale area here there are on each side two spines or hairs (antennæ-basal hairs?), the inner one curled at the ends into a circle and a-half. In face piece the central portion above has three hair points on each side and terminates in a rounded projection (labrum); beneath from each side are two rounded lappets (mandibles); these occupy about the central third of the face (Plate VI, Fig. 1); at the summit of the first pair of legs between the eyes and antennæ is a small separate portion (max. palp.). The maxillæ, second legs and antennæ reach to the extremity of the wings close to the hind margin of the fourth abdominal segment, to which they are fixed.

The maxillæ just fall short sufficient to show the extremities of the third pair of legs.

The first pair of legs extends two-thirds of the way down, and between these and the maxillæ, extending one-third of the way down from nearly the top of the maxilla, is a piece (first femur) jointed in the centre. The second leg has a small facet against the maxillary palp, cutting off the first entirely from the antennæ.

Each prothoracic portion has two hair points some distance apart; the two on the mesothorax are close together.

The metathorax appears to have two pairs on each side. The hind wings do not disappear under the fore wings till they have reached the fourth abdominal segment; they present a well marked Poulton's line; this is also very well marked along the extremity of the forewing.

The first four abdominal segments are fixed; the spiracles of the second and third find room by slightly indenting the wings.

The fifth and sixth segments are free. On the second and following abdominal segments is an anterior trapezoidal and a supraspiracular hair; also a prespiracular hair; and on the fourth and following a subspiracular hair. A posterior trapezoidal is nowhere determined distinctly; but above and behind the spiracles is a small pale area with three small circular lacunæ. The abdominal spiracles project as pale truncate cones.

The last segment terminates in a conical spine apparently with an elaborate armament, and has several fine hooks round its base and some hair-like spines in the anal region; but it is impossible to clear this of silk sufficiently to make sure of anything.

The whole surface of the pupa is marked by transverse lines or sulci waved and with fine branches running into the intermediate areas (Plate VI, Fig. 7), reminding one, especially on the wings, and probably similar in structure to the sulci between cerebral convolutions; these vary very much over different parts of the pupa; on the centre of the wing, for instance, forming a vortex like the ridges of the tip of the finger. On portions of the abdominal segments the fainter markings are disposed more like the folds in a cushion where it is upholstered. These folds are very beautiful on the antennæ, but here and elsewhere are too complicated for a detailed description. The claws (Plate VI, Fig. 2) on the true legs of the larva are remarkably long and narrow, the same length, and one-fourth the width of the preceding joint; this appearance is emphasized by this joint being of very uniform width and squarely truncated at its distal extremity. The pupal nerva-

tion of the wings is indicated by paler lines. Along the inner margin of the upper wings for quite the basal half is a narrow strip almost free from surface markings; this is, however, delusive, being really the surface of hard chitin of the upper wings which touches the lower one.

NOTE.—Dr. Chapman writes: "It belongs to my section, *Pyraloids*, which have obtect structure in practically all respects except the possession of traces of maxillary palps. I should be inclined to place it somewhere near Yponomeutidæ." The anal hooks were accidentally destroyed in the specimen that I sent to Dr. Chapman. The cremaster is a long, thick and wide projection with four hooks at the end (Plate VI, Figs. 4, 5 and 6). There is also a row of hooks at the base running around the anal aperture, and a series of stiff spines further forward, as shown in the figures.

Œta aurea was originally described by Fitch as a Lithosian; Riley placed it with the Tineids at first, later with the Zygænidæ; Smith put it in the Heterogynidæ in the list of 1891, but in the addendum Walsingham's opinion is quoted that the moth belongs to the Tineidæ, thus reverting to the original position given by Fabricius. The larva is a true Tineid. (See the description in March number of this JOURNAL.)

H. G. DYAR.

EXPLANATION OF PLATE VI.

Fig. 1. Leg cases, etc., of pupa; M., mandible; m. p., maxillary palpus; mx., maxilla; 1t., anterior trochanter; 1f., anterior femur; 1., first leg; 2l., second leg; 3l., third leg; a., antenna.

Fig. 2. Claw of larva.

" 3. Anterior (prothoracic) spiracle.

" 4. End of pupa, ventral view.

" 5. End of pupa, dorsal view.

" 6. End of pupa, lateral view.

" 7. Sculpturing of pupa shell.

A COMPARATIVE STUDY OF SEVEN YOUNG ARCTIANS.

PLATES VII AND VIII.

By HARRISON G. DYAR, PH. D.

The larvæ of the Arcticans, including in this term both Arctiidæ and Euchromiidæ, are much more highly specialized than those of the Noctuidæ. This specialization tends to force back into the first stage certain characters properly belonging to the later stages, and it is proposed to briefly consider some of the forms which this modification of stage I assumes.

The arrangement of the tubercles in stage I of the Arctians corresponds with that normal for the whole group Bombycides.* The setæ are of the finely spinulated type, with pointed tips, never glandular, in this respect distinguished from the Ptilodontidæ (Notodontidæ) and certain lower Tineid genera, as pointed out by Dr. Packard. The seven species taken to illustrate this paper, represent three unequal groups of the Arctian phylum. From the Arctiidæ proper I have taken *Spilosoma virginica* (Fig. 1), *S. antigone* (Fig. 2) and *Hyphantria cunea* (Fig. 3); from the Phægopterid group, *Halisidota maculata* (Fig. 4) and *H. caryæ* (Fig. 5); from the Euchomiidæ *Cosmosoma auge* (Fig. 6) and *Ctenucha virginica* (Fig. 7). I have arranged these as nearly as possible in ascending order of specialization, and it will be noticed how exactly this corresponds with the arrangement founded on the wing veins of the imago. That is, the *Spilosoma* group represents a more generalized type than the Halisidotas, the latter having reduced secondaries and shortened subcosta, whereas in the Euchromiidæ subcosta is entirely absent. The degree of difference of these groups also is the same in both larva and imago. While the larval Halisidotas are more specialized than the Spilosomas, they do not differ from them enough to determine family characters. The Euchromiidæ, however, do differ to this degree, the special character being the union of setæ ia, ib and iia on thorax to form a single wart. In *Halisidota*

* *I. e.*, the Noctuina as defined by me or Agrotides of Mr. Grote. I find that these names must be replaced by the old term Bombyces or Bombycides, because Bombyx really belongs to this superfamily, and not to the Saturniides, as I formerly supposed, following the conclusions of Professor Comstock. I have recently made a careful examination of stage I of Bombyx, at the suggestion of Mr. Grote, with the above result.

carya this process is foreshadowed on the metathorax, but while iia is partly united to i it forms a distinct wart on the mature larva.

This parallelism between the relative advance of larval and imaginal characters is worthy of notice in view of the numerous cases of the reverse tendency.

The details of the seven selected species are shown in the accompanying plate.

Spilosoma virginica.

The setæ are perfectly normal for stage I, all the subprimaries absent. Of the six primary setæ on the cervical shield, four remain on the shield, the others are detached and reduced, so that I detect only one seta on the small detached piece. The setæ of the prespiracular tubercle are also less than in the primitive Tineid stock. On the other thoracic segments, ia and ib are united, iib separate and reduced, all characteristic of the Bombycine type of wart formation. On the abdomen tubercle i is small, the rest large, vii with two setæ on segments 1 and 2, one on 7, 8 and 9, instead of the primitive three setæ; leg plates well marked. Tubercle viii present next the midventral line (not shown in the figure). "Joint 13" is evidently composed of two segments, on the anterior portion (9th abdominal) tubercles i to iii on one large wart, iv and v on another; on the anal plate (10th abdominal) all the five setæ on a single disk.

This is the type from which we start — an Arctian in the primitive first stage.

Spilosoma antigone.

The detached piece of the cervical shield is rudimentary. General tubercles as in *virginica*, except for a peculiar modification whereby tubercle iia on thorax has become three or four-haired (in different individuals) and iii on abdominal segments 1 to 8, four or five-haired; on the ninth abdominal iii seems to be only three haired, as I find but five hairs on the large wart composed of tubercles i to iii. No subprimary setæ; ventral setæ as in *virginica*.

This modification is to be interpreted as a partial wart formation, pushed back into stage I, yet unaccompanied by the subprimary setæ, which in phylogeny must have preceded any wart formation.

Not only in stage I is *S. antigone* unusually specialized for it genus, but in the later stages it has assumed the plumage and habits of *Arctai* (*Eyprepia*), as noticed by Mr. Hulst (Ent. Amer., II, 16). This specialization is not shared by the imago, and is consequently without

effect on the generic location of the species; it is probably the result of comparatively recent adaptation.

Hyphantria cunea.

Tubercles small, normal, two small areas detached from the cervical shield probably represent the two outer primitive setæ. Setæ all single as in *S. virginica*, but on the thorax subprimary seta iii is situated on a small wart behind seta iv and on the abdomen subprimary vi is present on segments 1 to 8, small anteriorly, but of fair size further back.

In this larva there is no precocious wart formation, but the subprimary setæ appear in stage I almost perfectly formed (v is absent on thorax). According to my views, the *Arctiidæ* are descended from the *Noctuidæ*, and here is a case where the specialization of the larva has crowded back into stage I the typical structures of the *Noctuidæ*, the primitive first stage being absent, yet without the supervention of wart formation until stage II.

Halisidota maculata.

As in *S. virginica*, but for a doubling of setæ iii on abdominal segments 1 to 8 and the partial fusion of iv with iii. Subprimary tubercles absent.

Here we have a partial precocious wart formation in the doubled setæ on iii analogous to the condition in *S. antigone* but considerably less developed, not affecting the thorax at all. I regard this species as more specialized than the preceding chiefly on account of the fusion of tubercles iv and iii, a condition found also in some of the Lymantriidæ, a high type in another line of evolution.

Halisidota caryæ.

Tubercle iv unconnected with iii, but iii doubled as in *H. maculata*. On segments 1 to 8 subprimary tubercle vi is present. No subprimaries on thorax, but iia partly fused with i on mesothorax; otherwise normal as in *S. virginica*.

This larva exhibits a partial precocious wart formation and a partial appearance in stage I of the subprimary tubercles. It therefore shows an incompletely developed combination of the characters of *Hyphantria cunea* and *Spilosoma antigone* and is consequently higher than either. It is more advanced than *H. maculata* in the presence of the subprimaries.

Cosmosoma auge.

Tubercles weak; setæ single, normal, no subprimaries. This larva is placed higher than all the preceding on account of the complete

union of tubercles iia and i on the thorax. In other respects there is present only a normal primitive first stage, just as in *S. virginica*, except for the purely specific characters of less cornified smaller tubercles, etc.

Ctenucha virginica.

Tubercles well developed, setæ all single as in *C. auge*, but in addition subprimary vi is present on abdominal segments 1 to 8; no subprimaries on thorax.

This represents in the Euchromiid phylum the same stage reached by *H. cunea* in the Arctiid branch, but not quite fully as there is here no trace of the subprimaries on the thorax.

EXPLANATION OF PLATES VII AND VIII.

Fig. 1. Spilosoma virginica, stage I.	Fig. 5. Halisidota caryæ,	Fig. I.
" 2. Spilosoma antigone, " "	" 6. Cosmosoma auge,	" "
" 3. Hyphantria cunea, " "	" 7. Ctenucha virginica,	" "
" 4. Halisidota maculata, " "		

PRELIMINARY HAND-BOOK OF THE COLEOPTERA OF NORTHEASTERN AMERICA.

BY ROLAND HAYWARD.

(Continued from Vol. V, p. 40.)

The present part of the "Hand-Book," relating to *Bembidium*, has been prepared at the request of the Editor of this JOURNAL, made some time ago, but the fulfilment of which has been unavoidably delayed. It is, in fact, an abridgment of a larger paper on the species occurring in America, north of Mexico, which the author had in preparation at the time when the request was made, and which has only recently been published (Trans. Amer. Ent. Soc., 1897, xxiv, pp. 32–143). To this the student is referred for more complete descriptions, as well as for bibliography and synonymy.

In order to economize space, the species have not been arranged in groups, as has been done in the paper above cited, but are all included in one table. It will be observed that in all but two of our species (*lævigatum* and *semistriatum*) the dorsal punctures of the elytra are confined either to the third interval or to the third stria. In those just cited, however, they are arranged in irregular rows on all the intervals,

with the setæ arising from them well marked. They are included in the category "third interval with dorsal punctures."

Bembidium *Latr.*

Antennæ slender, arising under a slight frontal margin, the two basal joints glabrous. Head with two supra-orbital setæ. Mandibles with a setigerous puncture in the scrobe. Palpi with the penultimate joint obconical, pubescent, the last joint small, subulate. Prothorax with a setigerous puncture each side and another in the hind angle. Elytra glabrous, striate, the margin interrupted posteriorly with an internal plica; sutural stria not recurved at apex. Mesosternal epimera wide. Middle coxal cavities entirely inclosed by the sterna. Anterior tibiæ deeply emarginate, the apical angle not obliquely truncate. Tarsi slender, the claws simple.

The males have the first two joints of the anterior tarsi dilated, the first slightly elongate, nearly quadrate, the second more or less triangular, with the inner angle slightly prolonged.

The species of this genus are very numerous. They are all below the average size, ranging from two to about nine millimeters. Most of them are riparial in their habits, though some are found in moss, amongst old leaves or under bark, while a few occur almost everywhere.

Synopsis of Species.

Eyes large or moderately large, convex.................................. 2
Eyes small, flattened.................................. 49

2. Elytra with the humeri subangulate, third interval with dorsal punctures.... 3
   Elytra with two dorsal punctures on the third stria.................. 12
   Elytra with the humeri rounded, third interval with dorsal punctures...... 28
3. Mentum with a short, bifid tooth; striæ of elytra more or less abbreviated behind.................................. 4
   Mentum with a large, entire tooth; striæ of elytra entire................ 5
4. Elytral intervals with rows of sparsely placed setigerous punctures.
   Robust, convex; green or bronzed, shining; prothorax subquadrate, slightly wider at base than apex; base of antennæ and legs testaceous, the femora sometimes darker. Length, .22–.29 inch; 5.5–7.25 mm.....**lævigatum.**
   Elytra with two dorsal punctures on the third interval.
   Robust, slightly convex; æneous or nigro-æneous; prothorax subquadrate, wider at base than apex; antennæ black, more or less rufous at base; legs black or dark piceous, often slightly æneous, the tibiæ and tarsi sometimes rufo-piceous. Length, .18–.28 inch; 4.5–7 mm..............**nitidum.**
5. Elytra with two impressed quadrate foveæ on the third interval, each enclosing a dorsal puncture.................................. 6
   Elytra without trace of foveæ; two dorsal punctures on the third interval.... 9

6. Elytra with the fourth stria sinuate.......... 7
Elytra with the fourth stria straight.................................. 8

7. Slender, elongate, convex; thorax as long as wide, not wider at base than apex, hind angles subacute; elytra deeply striate, the striæ distinctly punctate; legs æneous, the femora at base and the tibiæ more or less testaceous. Length, .19–.22 inch; 4.75–5.5 mm.................. .... **inæquale.**

Broader, less convex; thorax distinctly wider than long, slightly wider at base than apex; hind angles varying from subrectangular to subacute; elytra less deeply striate, the striæ more finely punctate; legs variable, usually nearly as in *inæquale*. Length, .19–.26 inch; 4.75–6.25 mm.............**littorale.**

8. Broad, slightly depressed; thorax nearly twice as wide as long, not wider at base than apex, sides arcuate in front, deeply sinuate behind, basal foveæ distinctly bistriate, hind angles subacute, carinate; elytra finely striate, the striæ finely punctate; legs varying from æneo-piceous to æneo-testaceous. Length, .22–.28 inch; 5.5–7 mm...**carinula.**

Robust; thorax about one-half wider than long, wider at base than apex, sides slightly arcuate in front, sinuate behind, basal foveæ feebly or obsoletely bistriate, hind angles prominent, acute; elytra deeply striate, the striæ deeply punctate; legs dark æneous, the femora at base and the tibiæ more or less rufous. Length, .22–.30 inch; 5.5–7.5 mm...........**punctatostriatum.**

9. Thorax wider at base than apex................................ 10
Thorax not wider at base than apex.................................. 11

10. Robust, bronzed, shining; thorax nearly twice as wide as long, sides arcuate in front, sinuate behind, hind angles acute, carinate; elytra moderately deeply striato-punctate; legs rufo-piceous, slightly æneous, the femora rufous at base. Length, .23–.25 inch; 5.75–6.25 mm. ....**robusticolle.**

11. Feebly convex; bronzed, varying to bluish-black, shining; thorax about one-half wider than long, sides moderately arcuate in front, sinuate behind; hind angles slightly prominent, subacute, very finely or obsoletely carinate; elytra deeply striato-punctate; legs æneo-piceous, the femora at base and the tibiæ rufous. Length, .22–.26 inch; 5.5–6.5 mm....................**coxendix.**

More robust; bronzed, usually coppery, elytra with the discs obscurely testaceous; thorax rather less than one-half wider than long, sides arcuate nearly to base, feebly sinuate in front of the hind angles, which are subrectangular and feebly carinate; elytra moderately deeply striato-punctate, the punctures usually greenish; legs testaceous. Length, .18–.27 inch; 4.5–6.75 mm.
confusum.

12. Eighth stria of the elytra moderately near, but distinct from the margin..... 13
Eighth stria of the elytra indistinct from the margin; humeri rounded...... 16

13. Humeri of elytra subangulate, all the striæ entire; hind angles of thorax not carinate; color more or less bronzed, sometimes greenish or bluish......... 14
Humeri of elytra rounded; hind angles of thorax carinate................. 15

14. Elytra with the dorsal punctures large, round, foveiform.
Thorax narrower at base than apex, sides moderately arcuate in front, slightly sinuate behind, hind angles subrectangular; elytra finely striate, very finely alutaceous, shining. Length, .20–.24 inch; 5–6 mm......**americanum**
Elytra with the dorsal punctures normal.

Broad, dilated, depressed; thorax narrower at base than apex, sides strongly arcuate in front, sinuate behind, hind angles obtuse; elytra moderately deeply striate, much more finely at tip; legs dark rufous. Length, .26–.29 inch; 6.5–7.25 mm, ... **dilatatum.**

More elongate, feebly convex; thorax scarcely narrower at base than apex, sides slightly arcuate in front, feebly sinuate behind, hind angles subrectangular; elytra more deeply striate; legs piceous, the femora at base and the tibiæ often rufous. Length, .23–.27 inch; 5.75–6.75 mm. . **honestum.**

More convex; thorax more narrowed behind, apex truncate, sides strongly arcuate in front, sinuate behind, hind angles subrectangular; elytra more deeply striate, the striæ more deeply, almost crenulately punctate. Length, .22–.25 inch; 5.5–6.25 mm. .... **chalceum.**

Elongate, depressed; thorax slightly narrower at base than apex, sides arcuate infront, sinuate behind, hind angles acute, slightly prominent; elytra moderately finely striate, the striæ distinctly punctate, with an ill-defined discal spot about one-third from apex testaceous; legs rufous. Length, .20–.23 inch; 5–6.75 mm. .... **blanchardi.**

15. Robust, very convex; nigro-æneous often tinged with green; thorax one-half wider than long, narrower at base than apex; elytra deeply striato-punctate, the striæ dilated, the first and second entire, the fifth represented by a groove at apex; base of antennæ and legs rufous. Length, .15–.18 inch; 3.75–4.5 mm. .... **nigrum.**

Less convex, elongate; black, slightly æneous; thorax narrower at base than apex, apex truncate; elytra with the first, second, third and seventh striæ entire; legs dark piceous or black. Length, .15–.18 inch; 3.75–4.5 mm. . . **longulum.**

More robust than *longulum*; nigro-æneous, the elytra sometimes tinged with brown; thorax scarcely narrower at base than apex, about one-half wider than long; elytra with all the striæ entire; legs piceous or rufo-piceous. Length, .15–.20 inch; 3.75–5 mm. .... **concolor.**

16. Thorax trapezoidal, scarcely convex, the basal foveæ distinctly bistriate with the outer stria as long or longer than the inner, hind angles distinctly carinate; legs dark 17

Thorax trapezoidal, scarcely convex, the basal foveæ unistriate or feebly bistriate with the outer stria very small, hind angles at most very finely carinate; legs rufous or testaceous, the femora rarely darker 18

Thorax cordate, convex, narrower at base than apex; basal foveæ bistriate . . 21

17. Form depressed; thorax slightly wider than long, as wide at base as apex; elytra finely striate, the striæ very finely or obsoletely punctulate; color piceous or nearly black, scarcely æneous; legs piceous. Length, .27–.35 inch; 6.75–8.75 mm. .... **planatum.**

Smaller species; striæ of elytra impunctate.

Elytra distinctly wider than the thorax; depressed, slender, elongate; nearly black, the elytra usually more or less brownish; thorax scarcely one-half wider than long, slightly narrower at base than apex, sides arcuate in front, oblique or obsoletely sinuate behind, hind angles obtuse, but not rounded; elytra moderately deeply striate; legs rufo-piceous. Length, .16–.19 inch; 4–4.75 mm. .... **simplex.**

Very close to *simplex*, but less elongate; thorax scarcely narrower at base than apex, sides sinuate behind, hind angles rectangular; legs piceous or nearly black, rarely rufo-piceous. Length, .16–.20 inch; 4–5 mm... **planiusculum.**

Elytra very slightly wider than the thorax, finely striate, the outer striæ very fine, especially towards the tip, dorsal punctures large; black, more or less bronzed, depressed; thorax nearly twice as wide as long, scarcely narrower at base than apex, sides arcuate to base, hind angles obtuse, but not rounded; legs black. Length, .17–.23 inch; 4.25–5.75 mm.............. **incertum.**

18 Basal impressions of thorax with the outer stria small, but distinct 19

Basal impressions of thorax with the outer stria obsolete; larger species..... 20

19. Thorax distinctly narrower at base than apex.

Elongate, slender, very depressed; piceous or nearly black, the elytra more or less brownish; thorax with the sides distinctly sinuate behind, hind angles rectangular; head large, scarcely narrower than the thorax; elytra slightly wider than the thorax, subparallel, deeply striato-punctate, all the striæ entire; legs rufous. Length, .21–.25 inch; 4.25–5.25 mm..... **grandiceps.**

Thorax very slightly narrower at base than apex.

Moderately elongate, depressed; head and thorax nigro-æneous, elytra dark brown or piceous, moderately deeply striato-punctate on the disc, less so at sides and tip, the five inner striæ entire, the sixth and seventh abbreviated behind, the latter often wanting; thorax about one-half wider than long, sides feebly sinuate behind, hind angles subrectangular; legs rufous. Length, .19–.22 inch; 4.75–5.5 mm. .... **guexi.**

Slightly elongate, less depressed, nearly black, usually slightly æneous or bluish; elytra less wide as compared with the thorax, striate nearly as in *guexi*, the six inner striæ entire, the seventh abbreviated behind or wanting; thorax more than one-half wider than long, sides obsoletely sinuate behind, hind angles slightly obtuse; legs rufous. Length, .22–.25 inch; 5.5–6.25 mm. .... **fugax.**

20. Head and thorax nigro-æneous, the latter with the hind angles rectangular or subobtuse; elytra testaceous with darker transverse bands or nigro-æneous transversely banded with testaceous, more or less deeply striato-punctate, the six inner striæ entire, the seventh varying from entire to wanting; legs testaceous or nearly rufous, the femora rarely darker. Length, .24–.34 inch; 6–8.5 mm. .... **transversale.**

21. Elytra each with a well-defined basal and another subapical spot pale; legs rufo-testaceous 22

Elytra either immaculate or with a pale submarginal spot near the apex 23

Elytra very pale testaceous, narrowly rufous or rufo-piceous along the suture to behind the middle, where there is a large spot of the same color, often connected with the margin by a narrow transverse line; head and thorax nigro-æneous; elytra finely striato-punctate, the five inner striæ entire; legs testaceous, the femora sometimes darker. Length, .17–.20 inch 4.25–5 mm. **fuscicrum.**

22. Thorax distinctly narrower at base than apex, sides strongly arcuate in front, deeply sinuate behind, hind angles rectangular; elytra moderately deeply striato-punctate, intervals convex. Length, .21–.25 inch; 5.25–6.25 mm.... **ustulatum.**

Thorax slightly narrower at base than apex, sides moderately arcuate in front, sinuate behind, hind angles rectangular; elytra moderately finely striato-punctate, intervals nearly flat; form less convex and color more brownish than in *ustulatum*. Length, .18–.26 inch; 4.5–6.5 mm .... **lucidum.**

23. Thorax wider than long 24

Thorax as long as wide; nigro-æneous, elytra often brownish at base with a submarginal pale spot about one-fourth from apex, which is rarely wanting, moderately finely striato-punctate, the first and second striæ entire, the fifth represented by a groove at apex; legs rufo-testaceous. Length, .16–.20 inch; .4–.5 mm .... **scopulinum.**

24. Head as wide as the thorax at apex 25

Head small, narrower than the prothorax at apex; elytra with a submarginal pale spots near the apex, which is rarely wanting.

Elongate, convex; elytra finely striato-punctate, the striæ not dilated, intervals feebly convex; antennæ piceous, the first joint rufous; legs rufous, the femora usually darker. Length, .24–.30 inch; 6–7.5mm. **bimaculatum.**

More convex; thorax more narrowed behind; elytra deeply striato-punctate, the striæ dilated on the disc, much finer at sides and tip; antennæ fuscous, the basal joints paler; legs pale yellowish tsetaceous. Length, .24–.28 inch; 6–7 mm .... **postremum.**

25. Elytra with the first and second striæ entire, the fifth either entire or represented by a groove at tip, the others abbreviated behind 26

Elytra with all the striæ entire; dark viridi-æneous, the elytra without submarginal pale spot, moderately deeply striato-punctate, more finely at sides and tip; legs rufous. Length, .22–.24 inch; 5.5–6 mm .... **canadense.**

26. Hind angles of thorax rectangular 27

Hind angles of thorax obtuse, but not rounded; rather slender, elongate, color varying from brownish to black, slightly æneous; elytra without submarginal pale spot, rather deeply striato-punctate; thorax with the sides feebly sinuate in front of the hind angles; legs rufous. Length, .23–.28 inch; 5.75–7 mm. **texanum.**

27. Moderately robust; black, usually slightly æneous or bluish, the elytra rarely with a submarginal pale spot, rather deeply striato-punctate; sides of thorax distinctly sinuate behind; legs rufous. Length .20–.24 inch; 5–6 mm. **picipes.**

Elongate, slightly convex; black, slightly æneous, elytra without submarginal pale spot, finely striate, striæ distinctly punctate; legs black or dark piceous. Length, .16–.18 inch; 4–4.5 mm .... **grapii.**

28. Elytra with two dorsal punctures on the third interval 29

Elytra with rows of sparsely placed, setigerous punctures on all the intervals; all the striæ abbreviated behind; frontal striæ normal 48

29. Frontal striæ normal; elytra distinctly striate, with at least the first and second striæ entire; striæ punctate 30

Frontal striæ double, oblique, the outer interrupted 42

Frontal striæ double, nearly parallel, the outer entire 45

Frontal striæ very oblique, strongly convergent, double, the outer often very feeble, abbreviated behind 46

30. Thorax narrower at base than apex 31
Thorax not perceptibly narrower at base than apex 38
31. Form depressed; all the striæ of the elytra entire 32
Form more or less convex 33
32. Head and thorax coarsely alutaceous, cupreo-æneous, elytra testaceous with a humeral spot, a small oblong spot on third interval, about one-third from base, and two transverse bands bronzed or nearly black, the first slightly behind the middle, the second about one-fourth from apex, the last three connected by a narrow sutural line; thorax cordate, nearly twice as wide as long; base of antennæ and legs testaceous. Length, .20–.24 inch; 5–6 mm..... **cordatum.**
Dark viridiæneous, elytra with the apex, a subapical spot, and rarely a short transverse band in front of the middle testaceous; head and thorax alutaceous, the latter subquadrate, slightly narrower at base than apex, sides at most obsoletely sinuate behind, hind angles obtuse; legs rufous or rufo-piceous. Length, .15–.18 inch; 3.75–4.5 mm .... **intermedium.**
33. Elytra with all the striæ entire; thorax more or less cordate 34
Elytra with several striæ abbreviated behind 35
34. Head and thorax nigro æneous, the former finely alutaceous; elytra æneo-piceous with a subhumeral blotch, a transverse band behind the middle and sometimes the apex paler, the markings ill-defined; form elongate; legs testaceous. Length, .20–.23 inch; 5–5.75 mm .... **graciliforme.**
Head and thorax viridiæneous, alutaceous, elytra testaceous with a transverse band slightly behind the middle, another between this and the apex and sometimes a subbasal cloud fuscous, striæ scarcely less deep at tip; legs testaceous. Length, .16–.18 inch; 4–4.5 mm .... **viridicolle.**
Dark viridi-æneous, elytra usually with a narrow transverse band about one-third from base, another about one-third from apex and an apical spot testaceous, the three usually connected along the margin; head alutaceous; elytral striæ much finer at tip; legs testaceous. Length, .16–.18 inch; 4–4 5 mm. **fraternum.**
Much smaller, elongate; head and thorax black or slightly æneous, the former very finely alutaceous; elytra varying from testaceous with black markings to nearly black with paler markings; legs rufous. Length, .10–.13 inch; 2.5–3.25 mm .... **timidum.**
35. Thorax with the hind angles distinctly carinate 36
Thorax with the hind angles very finely or not carinate; head distinctly alutaceous; larger species 37
36. Head at most very finely alutaceous; form and color nearly as in *timidum*, but slightly more elongate and more convex, with the sides of the thorax usually more deeply sinuate behind; elytra with the first and second striæ entire, the fifth represented by a groove at tip; legs testaceous. Length, .10–.13 inch; 2.5–3.25 mm .... **versicolor.**
Head not alutaceous; robust; black, slightly æneous; sides of thorax arcuate in front, oblique behind, hind angles obtuse; elytra slightly wider than the thorax, with the first, second and fifth striæ entire; legs piceous. Length, .11–.13 inch; 2.75–3.25 mm .... **morulum.**
37. Moderately convex, elongate; æneous or nigro-æneous, elytra with the apex, a sub-

apical spot, often a short transverse band in front of the middle and a narrow line along the margin testaceous; thorax with the sides arcuate nearly to base, sinuate in front of the hind angles, which are subrectangular and finely, almost obsoletely, carinate; legs rufo-testaceous. Length, .17–.22 inch; 4.25–5.5 mm. .... **constrictum.**

Convex, slender, very elongate; color nearly as in *constrictum*, the apex and margin of the elytra more or less testaceous; thorax with the sides arcuate to base, hind angles obtuse, not carinate; legs rufo-testaceous. Length, .18–.24 inch; 4.5–6 mm.................................. **contractum.**

38. Thorax squarely truncate at base; head alutaceous...................... 39

Thorax slightly obliquely truncate each side at base..................... 41

39. Hind angles of thorax rectangular.................................. 40

Hind angles of thorax obtuse; feebly convex; head and thorax viridi-æneous elytra fuscous, with a humeral lunule, a transverse fascia behind the middle and the apex testaceous; thorax with the sides arcuate to base; elytra very slightly wider than the thorax; legs rufo-testaceous. Length, .16–.18 inch; 4–4.5 mm .... **æneicolle.**

40. Nigro-æneous; elytra moderately deeply striate, marked nearly as in *graciliforme*, the markings ill-defined; head and thorax rather finely alutaceous; legs varying from rufous to piceous. Length, .20–.24 inch; 5–6 mm. **dentellum.**

Brown bronze, elytra testaceous, marked somewhat as in *cordatum*, the markings ill-defined and broader; head and thorax very distinctly alutaceous; legs rufo-testaceous. Length, .17–.19 inch; 4.25–4.75 mm. ....**versutum.**

Nigro æneous, elytra either testaceous variegated with black, or black variegated with testaceous, the markings well defined.

Legs testaceous. Length, .14–.19 inch; 3.5–4.75 mm....... **variegatum.**

Legs black or dark piceous. Length .13–.16 inch; 3.25–4 mm...**nigripes.**

41. Head not alutaceous; form and color nearly as in *postfasciatum*; elytra without postscutellar depression, more finely striate, the striæ not dilated at base, the markings narrower and paler; head and thorax bright viridi- or cupreo-æneous; legs testaceous. Length, .20–.23 inch; 5–5.75 mm......**dorsale.**

Head alutaceous; broad, dilated; elytra more than one-half wider than the thorax, deeply striate, the striæ dilated at base, with a transverse depression behind the scutellum; head and thorax cupreo-æneous, elytra testaceous with a small spot on the third interval about one-third from base, a transverse band about the middle and another between this and the apex nearly black; legs testaceous. Length, .20–.24 inch; 5–6 mm.........**postfasciatum.**

42. Thorax cordate, pedunculate or subpedunculate; form moderately elongate; hind angles of thorax not carinate; elytral striæ abbreviated behind.......... 43

Thorax cordate or subcordate, truncate at base.......................... 44

43. Moderately convex, slender; black, slightly æneous, elytra with a subhumeral pale spot; thorax less than one-half wider than long; legs piceous or nearly black, the tibiæ and tarsi usually paler. Length, .12–.14 inch; 3–3.5 mm. **mutatum.**

Moderately convex; brownish æneous, elytra with a subhumeral spot and usually a small submarginal one behind the middle yellowish testaceous; thorax

scarcely wider than long; legs yellowish testaceous. Length, .12–.14 inch; 3–3.5 mm. .... **pedicellatum.**

Slightly depressed; color varying from brownish to nearly black, slightly æneous, elytra with a large, triangular subhumeral spot, and a smaller one, behind the middle, yellowish testaceous; thorax rather more than one half wider than long; legs yellowish testaceous. Length, .10–.14 inch; 2.5–3.5 mm. **quadrimaculatum.**

44. Black, slightly æneous; thorax cordate, slightly wider than long, very distinctly narrower at base than apex, basal impressions unistriate; elytra more than one-half wider than the thorax, variegated with testaceous markings along the margin; legs testaceous. Length, .10–.14 inch; 2.5–3.5 mm....... **affine.**

Piceous or nearly black, the elytra often tinged with brown, unicolorous; thorax about one-half wider than long, subcordate, slightly narrower at base than apex, basal impressions bistriate; elytra slightly wider than the thorax; legs rufo-testaceous. Length, .10–.13 inch; 2.5–3.25 mm..... ...**muscicola.**

45. Slightly elongate, moderately convex; black, often tinged with greenish, elytra with a subapical spot and the apex pale; thorax subquadrate, slightly narrower at base than apex, hind angles carinate; elytra moderately finely striate, the striæ abbreviated behind, the two inner nearly entire; legs rufo-testaceous. Length, .13–.14 inch; 3.25–3.5 mm......................... **sulcatum.**

46. Thorax distinctly wider than long; elytra about one-half wider than the thorax. 47

Thorax scarcely wider than long; hind angles rectangular; convex, nigro-æneous, the elytra often brownish, deeply striato-punctate, with a subapical spot and the apex pale testaceous, legs testaceous. Length, .08–.11 inch; 2–2.75 mm.. **assimile.**

47. Hind angles of thorax acute; form slightly elongate, convex; color black, scarcely æneous, the elytra with a subapical spot and the apex more or less testaceous; basal impressions of thorax unistriate; elytra finely striato-punctate; legs piceous or rufo-piceous. Length, .13–.15 inch; 3.25–4 mm. **anguliferum.**

Hind angles of thorax rectangular; less elongate than *anguliferum*; color nearly as in that species, the elytral spots more marked; basal impressions of thorax bistriate; striæ of elytra deeper; legs rufous or pale rufo-piceous. Length, .12–.15 inch; 3–3.75 mm.................................... **cautum.**

48. Slightly elongate, convex; black, scarcely æneous; thorax distinctly narrower at base than apex; striæ of elytra with deep, not closely placed punctures; legs yellowish testaceous. Length, .15–.17 inch; 3.75–4.25 mm. .**semistriatum.**

49. Maxillæ with the outer lobe biarticulate; elytra with two dorsal punctures on the third striæ.

Thorax about one-half wider than long, basal impressions moderately deep; elytra oblong-ovate, slightly wider than the thorax, deeply striate, the striæ entire; form elongate, depressed; color dark rufous, the elytra varying to slate-color; legs rufous. Length, .14–.16 inch; 3.5–4 mm. **puritanum.**

Maxillæ with the outer lobe with the two joints united; mandibles long, slender, nearly straight; elytra with two dorsal punctures on the third interval.

Feebly convex; rufous or rufo-piceous; thorax slightly wider than long, dis-

tinctly narrower at base than apex, hind angles rectangular; striæ of elytra sparsely and very finely punctate; legs rufous. Length, .17–.22 inch; 4.25–5.5 mm. .... **oblongulum.**

B. **lævigatum** *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 84.

A large and easily recognized species. By the arrangement of the dorsal punctures it recalls *semistriatum.*

Habitat: New Hampshire to South Carolina and westward to Montana and Texas.

B. **nitidum** *Kirby.*—Faun. Bor. Am. 1837, IV, p. 55, tab. 1, Fig. 7 (*Peryphus*).

Habitat: Canada and the more northern portions of the country from the Atlantic to the Pacific.

B. **inæquale** *Say.*—Journ. Ac. Phil. 1823, ser. i, III, p. 151.

In color this species is usually greenish bronze. The surface is more or less alutaceo-granulate with elevated smooth spaces.

Habitat: The eastern portions of the country, extending westward to the Rocky Mountains and Texas.

B. **littorale** *Oliv.*—Ent. 1790, II, p. 6, pl. i, Fig. 7 a b.

A variable species. The surface is more or less alutaceo-granulate and the color varies from bronze to nearly black. The elevated smooth spaces of the elytra vary in number and extent.

Habitat: The more northern portions of the continent from the Atlantic to the Pacific. It occurs also in Europe and Siberia.

B. **carinula** *Chaud.*—Rev. et Mag. Zoöl. 1868, ser. 2, XX, p. 239.

Habitat: The more northern portions of the continent from the Atlantic to the Pacific.

B. **punctatostriatum** *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 83.

The color is bronzed. The surface is more shining than in the last three species, and, as a consequence, the elevated smooth spaces of the elytra are feeble or nearly obsolete. The quadrate foveæ on the third interval are also less marked.

Habitat: From the Atlantic to the Pacific, extending as far south as Arkansas.

B. **robusticolle** *Hayw.*—Trans. Am. Ent. Soc. 1897, XXIV, p. 50.

Habitat: Michigan, Iowa and Kansas.

B. coxendix *Say*.—Journ. Ac. Phil. 1823, ser. i, III, p. 151.

Habitat: Illinois, Lake Superior region, Manitoba, Nebraska, Kansas, Colorado, New Mexico and Texas.

B. confusum *Hayw*.—Trans. Am. Ent. Soc. 1897, XXIV, p. 52.

This species has for some time been regarded as a variety of the preceding, but seems distinct by the characters above given. It is the *nitidulum* of Dejean.

Habitat: The Eastern United States, extending westward to Colorado.

B. americanum *Dej*.—Spec. 1831, V, p. 84.

This and the next four species differ from the others in which the dorsal punctures are placed on the third stria by the subangulate elytral humeri.

Habitat: The greater part of the region east of the Rocky Mountains.

B. dilatatum *Lec*.—Ann. Lyc. 1848, IV, p. 455 (*Ochthedromus*).

But two specimens are known to me. Of these one is Leconte's type, from Columbia, Pa. The other is from the Indian Territory and in Dr. Horn's collection.

B. honestum *Say*.—Trans. Am. Phil. Soc. 1823, II, p. 82.

This has been previously known as *antiquum* Dej. It approaches the next very closely.

Habitat: Canada and the United States from the Atlantic to the Rocky Mountains and Texas.

B. chalceum *Dej*.—Spec., 1831, V, p. 88.

Habitat: The same region as the preceding, but apparently less abundant.

B. blanchardi *Hayw*.—Trans. Am. Ent. Soc. 1897, XXIV, p. 56.

Habitat: Lowell, Mass.

B. nigrum *Say*.—Trans. Am. Phil. Soc. 1823, II, p. 85.

Habitat: Canada and the Eastern and Central States, extending westward to Iowa and Kansas.

B. longulum *Lec*.—Ann. Lyc. 1848, IV, p. 457 (*Ochthedromus*).

Habitat: Lake Superior region, the Rocky Mountains and California.

B. concolor *Kirby.*—Faun. Bor. Am. 1837, IV, p. 54 (*Peryphus*).

Habitat: Maine, the Lake Superior region and from thence westward to the Pacific Coast. It is essentially a northern species.

B. planatum *Lec.*—Ann. Lyc. 1848, IV, p. 456 (*Ochthedromus*).

Our largest species of *Bembidium*. In form it recalls certain species of *Platynus*.

Habitat: Lake Superior, the Rocky Mts., Nevada, Oregon, Washington and British Columbia.

B. simplex *Lec.*—List Col. N. Am. 1863, p. 14 (list name); Hayw., Trans., Am. Ent. Soc. 1897, XXIV, p. 63.

Very closely allied to the next species.

Habitat: Labrador, Canada, the Hudson Bay Territory, the White Mts. of New Hampshire, Vermont, Massachusetts, the mountains of North Carolina, the Lake Superior region and Missouri.

B. planiusculum *Mann.*—Bull. Mosc. 1843, XVI, p. 215.

Habitat: Lake Superior, the Rocky Mts. and from thence westward to the Pacific Coast and northward to Alaska. But two specimens have been seen by me from the Lake Superior region.

B. incertum *Mots.*—Bull. Mos. 1845, XVIII, p. 350 (*Notaphus*).

The dorsal punctures are larger and more prominent than in most of the species of the genus.

Habitat: Lake Superior region, the Rocky Mountains, Alaska and the Northwest.

B. grandiceps *Hayw.*—Trans. Am. Ent. Soc. 1897, XXIV, p 70.

The head is unusually large in this species, being scarcely narrower than the thorax.

Habitat: Massachusetts, New York, Pennsylvania, the District of Columbia and Texas. It seems to be local.

B. guexi *Chaud.*—Rev. et Mag. Zoöl. 1868, ser. 2, XX, p. 242.

Habitat: The northeastern States, extending southward to Virginia and westward to Lake Superior.

B. fugax *Lec.*—Ann. Lyc. 1848, IV, p. 467 (*Ochthedromus*).

Habitat: Canada, Vermont, Massachusetts, New York, New Jersey, Pennsylvania, Ohio, Michigan and Illinois.

B. transversale *Dej.*—Spec. 1831, V, p. 110.

A very variable species. As here constituted it includes several species that were based upon characters which become evanescent when a large series of specimens is studied.

Habitat: Gulf of the St. Lawrence, Canada, Michigan and the Lake Superior region and from thence westward to the Pacific Coast.

B. canadense *Hayw.*—Trans. Am. Ent. Soc. 1897, XXIV, p. 77.

This species differs from its allies in having all the striæ of the elytra entire. It most nearly resembles the western *B. striola.*

Habitat: Ottawa, Canada.

B. bimaculatum *Kirby.*—Faun. Bor. Am. 1837, IV, p. 52 (*Peryphus*).

Habitat: The more northern portions of the continent from the Atlantic to the Pacific, extending southward in the mountainous regions to Colorado and Nevada.

B. postremum *Say.*—Trans. Am. Phil. Soc. 1834, IV, p. 437.

Habitat: Massachusetts (Lowell), New York, Pennsylvania (Allegheny) and Illinois. Apparently quite local.

B. ustulatum *Linn.*—Syst. Nat. 1758, I, p. 416 (*Carabus*).

Habitat: The region east of the Rocky Mountains, Europe and Siberia.

B. lucidum *Lec.*—Ann. Lyc. 1848, IV, p. 466 (*Ochthedromus*).

It resembles the preceding very closely and may possibly prove to be merely a variety of that species.

Habitat: Hudson Bay Territory, Lake Superior region, Minnesota, Manitoba, and from thence westward to the Pacific Coast.

B. fuscicrum *Mots.*—Etud. Ent. 1855, p. 79.

Habitat: Manitoba, Montana, Wyoming, Colorado, Utah and Oregon.

B. scopulinum *Kirby.*—Faun. Bor. Am. 1837, IV, p. 53 (*Peryphus*).

A very pretty and well-marked species.

Habitat: Labrador, Canada, Manitoba and the more northern States, extending westward to Colorado.

B. picipes *Kirby.*—Faun. Bor. Am. 1837, IV, p. 54 (*Peryphus*).

Specimens rarely are seen with a submarginal pale spot. This is the form described as *plagiatum* Zimm.

Habitat: Eastern States, Lake Superior region, Minnesota, Missouri and Texas.

B. texanum *Chaud.*—Rev. et Mag. Zoöl. 1868, ser. 2, XX, p. 240.

Habitat: Iowa, Missouri, Indian Territory and Texas.

B. grapii *Gyll.*—Ins. Suec. 1827, IV, p. 403.

Habitat: Northern Europe, Greenland, the more northern portions of this continent, and high altitudes in the White Mountains of New Hampshire, the Rocky Mountains and the Sierras.

B. cordatum *Lec.*—Ann. Lyc. 1848, IV, p. 457 (*Ochthedromus*).

Habitat: New York, Missouri, Nebraska, Colorado, Indian Territory and Texas.

B. graciliforme *Hayw.*—Trans. Am. Ent. Soc. 1897, XXIV, p. 97.

This species has been confused with the next in collections. It is, however, more slender, and differs essentially in the form of the thorax.

Habitat: Massachusetts, Pennsylvania, Michigan, Illinois and Iowa.

B. dentellum *Thunb.*—Mus. Nat. Ac. Ups. 1785, p. 50, not 10 (*Carabus*).

In this and the preceding the markings are ill-defined.

Habitat: The northern portions of this continent and Europe.

B. versutum *Lec.*—Proc. Am. Phil. Soc. 1878, XVII, p. 594.

Habitat: New Hampshire, Massachusetts, Michigan and Wisconsin.

B. dorsale *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 84.

Habitat: The central region of the country. It seems to be most abundant in the States between the Mississippi River and the Rocky Mountains.

B. postfasciatum *Hamilton.*—Can. Ent. 1893, XXV, p. 303.

Confused in many collections with the preceding, which it resembles uite closely.

Habitat: Massachusetts, Pennsylvania, Ohio, Illinois, Iowa, Kansas and Texas.

B. viridicolle *Laferté.*—Rev. Zoöl. 1841, p. 48 (*Notaphus*).

Habitat: Massachusetts, the Central States, Manitoba and the Rocky Mountains.

B. fraternum *Lec.*—Proc. Ac. Phil. 1857, p. 6.

Habitat: Louisiana, Florida, Georgia, Virginia, Pennsylvania and Massachusetts.

B. æneicolle *Lec.*—Ann. Lyc. 1848, IV, p. 459 (*Ochthedromus*).

Habitat: Lake Superior region, Manitoba, Wyoming and Colorado.

B. variegatum *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 89.

A very variable species. As defined by me, it includes *patruele* Dej. and *conspersum* Chaud., there being apparently no constant characters for their separation.

Habitat: The greater part of the United States and Canada from the Atlantic to the Pacific.

B. nigripes *Kirby*—Faun. Bor. Am. 1837, IV, p. 57 (*Notaphus*).

Capable of but feeble distinction from the preceding. The legs are dark piceous or black, and the form is rather less elongate, while the size averages somewhat smaller.

Habitat: Anticosti and the Gulf of the St. Lawrence, the Lake Superior region, Manitoba, Alberta, the Rocky Mountains, Oregon, Washington, British Columbia and Vancouver Island.

B. intermedium *Kirby.*—Faun. Bor. Am. 1837, IV, p. 58 (*Notaphus*).

Habitat: Illinois, Manitoba, Montana, Nebraska, Kansas, Indian Territory, Mississippi, Texas, Colorado, New Mexico, Arizona and southern California.

B. timidum *Lec.*—Ann. Lyc. 1848, IV, p. 460 (*Ochthedromus*).

Habitat: Lake Superior region, Manitoba, Colorado, Utah, Nevada and along the Pacific Coast from California to British Columbia.

B. versicolor *Lec.*—Ann Lyc. 1848, IV, p. 460 (*Ochthedromus*).

Habitat: The greater part of the United States and Canada.

B. constrictum *Lec.*—Ann. Lyc. 1848, IV, p. 462 (*Ochthedromus*).

Habitat: The Atlantic Coast, extending westward to the Rocky Mountains and Texas.

B. contractum *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 85.

Closely allied to the preceding, but differs, in addition to the characters above given, by its more slender and elongate form.

Habitat: The Atlantic States from Massachusetts to Florida and westward to Ohio and Tennessee.

B. morulum *Lec.*—New Species Coleopt. 1863, pt. i, p. 19.

Habitat: Hudson Bay Territory.

B. mutatum *G. & H.*—Cat. 1868, I, p. 416.

Habitat: Hudson Bay Territory, Mt. Washington, N. H., Lake Superior region and high altitudes in the Rocky mountains.

B. pedicellatum *Lec.*—Proc. Ac. Phil. 1857, p. 6.

Habitat: Pennsylvania, District of Columbia, Maryland and Missouri. Apparently very local

B. quadrimaculatum *Linn.*—Syst. Nat. 1758, I, p. 416 (*Carabus*).

Habitat: The entire region east of the Rocky Mountains, Europe and Siberia.

B. affine *Say.*—Trans. Am. Phil. Soc. 1823, II, p. 86.

Habitat: The Atlantic and Central States, extending southward to Florida, Texas and Arizona.

B. muscicola *Hayw.*—Trans. Am. Ent. Soc. 1897, XXIV, p. 122.

This species has for some time been erroneously regarded as the European *B. lampros* Hbst.

Habitat: Canada, New Hampshire, Massachusetts, Michigan and Illinois. Specimens have been seen labeled "Cal."

B. sulcatum *Lec.*—Ann. Lyc. 1848, IV, p. 463 (*Ochthedromus*).

Habitat: Canada, Hudson Bay Territory, Massachusetts, the Lake Superior region and Illinois.

B. anguliferum *Lec.*—Ann. Lyc. 1852, V, p. 185 (*Ochthedromus*).

Often confused with *cautum*, from which it is rather feebly distinct, by the characters above given.

Habitat: California, Vancouver Island, Nevada, Manitoba, Michigan, Pennsylvania, New Hampshire (Mt. Washington) and Canada.

B. cautum *Lec.*—Ann. Lyc. 1848, IV, p. 464 (*Ochthedromus*).

Habitat: Alaska, Washington, Utah, the Rocky Mountain region and Massachusetts. It has also been recorded from Mt. Washington, N. H., and from Michigan.

B. assimile *Gyll.*—Ins. Suec. 1810, II, p. 26.

Habitat: The greater part of North America and Europe.

B. semistriatum *Hald.*—Proc. Soc. Phil. 1843, I, p. 303 (*Lopha*).

Recalls *lævigatum* by the arrangement of the dorsal punctures.

Habitat: New Hampshire, Massachusetts, Pennsylvania and Kentucky.

B. puritanum *Hayw.*—Trans. Am. Ent. Ac. 1897, XXIV, p. 129.

Resembles most closely the Californian *B. laticeps*.

Habitat: Massachusetts.

B. oblongulum *Mann.*—Bull. Mosc. 1852, XXV, p. 298 (*Trechus*).

Referable to *Amerizus* Chaud., by the peculiar structure of the outer lobe of the maxillæ, were that genus allowed to stand.

Habitat: Canada, Vermont, the White Mountains of New Hampshire, Massachusetts (Lowell), Ohio, Michigan, Alaska, California and Mexico.

(*To be continued.*)

BIOLOGICAL NOTES ON SOME COLEOPTERA FROM NEW MEXICO.

By T. D. A. Cockerell, Mesilla, N. M.

In the course of some studies of plant fauna, the following memoranda have been made. The contemplated work treating of the several plant faunæ in detail is not likely to be finshed for some years, so it may be well to offer some of the results in advance.

CHRYSOMELIDÆ.

Calligrapha serpentina *Rog.*

In Mesilla this breeds abundantly on *Sphæralcea angustifolia.* On July 20 I found one ovipositing on the under side of a leaf next to the midrib. The eggs are placed irregularly in a heap, loosely united by a viscid secretion, the majority endwise on the leaf. The egg is 2 mm. long, cylindrical, rounded at each end, pink (the color of a red raspberry, granular from the presence of innumerable closely-placed low tubercles, the extreme tips smooth and shining. Although the egg masses are very conspicuous at a short distance, they could be overlooked easily on the plant, being about the size and color of the flowers. The larvæ are gregarious on the under side of the leaf and are brown-black to dark brown, with long black hairs on which appear pale objects which, on close inspection, are seen to be the stellate hairs of the plant detached. I do not describe the larvæ further, as I sent some to Professor Wickham, who will probably describe and figure them.

Chrysomela tortuosa *Rog.*, (det. Wickh.)—On July 10 I took one at Deming on *Ephedra.*

Doryphora decemlineata *Say.*—Abundant on *Solanum elæagnifolium* in Mesilla, breeding. This species belongs to the Upper Sonoran,

not the Transition, and in New Mexico *S. elæagnifolium* is its normal food plant.

Coptocycla clavata *Fab.*, (det Wickh.)—On *Physalis* in Mesilla.

Chelymorpha argus *Licht.*, (det. Wickh.)—In August on *Solanum elæagnifolium* in Mesilla.

Colaspis flavida *Say*, (det. Wickh.)—Rather common on cultivated (mission) grape vines in Mesilla, July 22, etc.

CURCULIONIDÆ.

Trichobaris compacta *Casey*, (det. Wickh.)—Common in Mesilla on *Datura metelioides*, breeding in the stems.

Otidocephalus vittatus *Horn*, (det. Natl. Mus.)—Common on *Bigelovia graveolens*, var., Tularosa Creek, below the Mescalero Agency, October 2. The species found on *Bigelovia* in the Mesilla Valley has been referred to *O. nivosus* Casey.

SCARABÆIDÆ.

Atænius inops *Horn*, (det. Wickh.)—Flying in great numbers in a sandy place, about 5:30 P. M., beginning of October, at Las Cruces.

Cyclocephala dimidiata *Burm.*—Common at Mesilla in flowers of *Datura metelioides*. Also at Selden.

SCOLYTIDÆ.

Xylocleptes cucurbitæ *Lec.*, (det. Dep. Agr.)—Bred in the spring of 1897 in numbers from dead stems of *Cucurbita fœtidissima* (=*perennis*) in Mesilla.

LAGRIIDÆ.

Statira opacicollis *Horn.*—San Augustine, on the east side of the Organ Mountains, August 29, in great numbers in flowers of *Datura*.

BUPRESTIDÆ.

Agrilus couesii *Lec.*—Santa Fé, August 3, on *Mentzelia nuda*.

Anthaxia æneogaster *Lap.*—Ruidoso Creek, 7,500 feet, on *Rosa fendleri* (E. O. Wooton. coll.).

The dragonfly mentioned on p. 94, of the June number of the JOURNAL, as *Lestes virgo* Hagen (sp. n.) [in MS.], is, I find after examination of Hagen collection in the Museum of Comparative Zoölogy, at Cambridge, Mass., the same as *Lestes inequalis* Walsh.—Philip P. Calvert.

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AN ATTEMPT TO CLASSIFY THE HOLARCTIC LEPIDOPTERA BY MEANS OF THE SPECIALIZATION OF THE WINGS.

PART I.—THE DAY-BUTTERFLIES.

By A. RADCLIFFE GROTE, A.M.

A. Forewings with vein IX present........................ **PAPILIONIDES.**
  a 1. Vein IV2 of primaries inclines to Cubitus .... PARNASSIIDÆ.
    a2. Vein IV1 of forewings from Radius .... PARNASSIINÆ.
    d2. Vein IV1 of forewings from crossvein .... THAIDINÆ.
  a 1. Vein IV2 of primaries placed centrally .... PAPILIONIDÆ.

B. Forewings with vein IX wanting........................ **HESPERIADES.**
  b1. Radial veins on primaries not arising separately, or if separate less than five in number.
  b2. Vein III4 to costa before apex.
  b3. Wings not angulate.
  b4. Vein IV2 not central on both wings......................... PIERIDÆ.
    b5. Vein III1 arising from above cell....................... PIERINÆ.
    b5. Vein III1 arising beyond cell......................... LEPTIDIINÆ.
  b2. Vein III4 to external margin below apex.............. NYMPHALIDÆ.
    b6. Vein II absorbed by III to junction with I on secondaries NYMPHALINÆ
    b6. Vein II absorbed by III to a varying point but always before junction with I .... ARGYNNINÆ.
  b2. Vein III4 to apex.
    b7. Vein VIII not marked on primaries .... AGAPETIDÆ.
      b8. Crossvein of secondaries joins Cubitus.............. PARARGINÆ.
      b8. Crossvein of secondaries joins vein IV3 .... AGAPETINÆ.
  b3. Wings angulate...... .... LIBYTHEIDÆ.
    b7. Vein VIII marked on primaries.
    b9. Vein III2 beyond extremity of cell................ LIMNADIDÆ.
    b9. Vein III2 before extremity of cell................. NEMEOBIIDÆ.
  b4. Vein IV2 central on both wings.
    b10. Vein I of hind wings developed.................... RIODINIDÆ.
    b10. Vein I of hind wings absent...................... LYCÆNIDÆ.
      b 11. Vein IV1 of primaries directly joining Radius ..... THECLINÆ.
      b 11. Vein IV1 of primaries indirectly joining Radius ... LYCÆNINÆ.

b1. Radial veins on primaries arising separately and five in number.
b12. Vein IV2 of primaries approaching cubitus.....MEGATHYMIDÆ.
b12. Vein IV2 of primaries placed centrally............HESPERIADÆ.
b13. No costal vein (vein I) on primaries.............PAMPHILINÆ.
b13. A costal vein (vein I) on primaries...............HESPERINÆ.

The division of the Day Butterflies rests upon the presence of a strong and short downwardly curved vein at the base of primaries and joining the internal margin in the Parnassi-Papilionidæ, and its absence in all the other Day Butterflies. Whether we homologize this vein with the loop at the base of vein VII, which we call VIII, or give it a separate number the character is unaffected, for the loop runs in a contrary direction, and the opposite development of the vein in the Swallow-tails remains to be accounted for. But I cannot so homologize this peculiar vein and for several reasons. We find in *Castnia*, *Actias*, *Telea*, *Thyridopteryx*, a lower prolongation of the loop VIII. It seemed to me at one time that here might be a trace of this vein IX which would have anastomosed with VIII and finally have disappeared. But the greatest encouragement, that I might discover the phylogeny of *Papilio*, was offered me by the drawings of Mr. Meyrick in the Geometridæ. For here appeared vein VIII as a degenerate (dotted in the drawings) nervure, and, behold, IX was present likewise and indicated by a curved continuous line joining internal margin as in *Papilio*. Here I said, can I never be mistaken. This is the internal vein of the Papilionides. But when I, myself, tried to find Mr. Meyrick's vein in nature, it was not there. The pertinacity with which Mr. Meyrick repeats this vein in his drawings of the Geometrid wing leads one to suspect that he has really perceived it on some special occasion and now brings it in (*i. e.*, *Venilia macularia*) where there is no occasion. But I have small hopes.

The general resemblances, striking as they may be between the Hesperiades and Papilionides, or between *Papilio* and the rest of the Day Butterflies, might be all developed upon another line and the connection between the two would in that case be placed farther back still. Any system which places the Papilionides between the groups of the other Day Butterflies, all of which appear to me to hang more or less closely together, must first account for the fundamental neurational differences before it can be entitled to credit. The diurnal habit might be set down, with other features, to convergence.

There are two chief directions in which changes are making in the structure of the butterfly wing. The first is traceable throughout the order. Its aim is the breaking up of the system of theMedia, one

of the three primary veins. Its progress is not uniform, but is evidenced in different ways. The comparative completion of this effort affords a particular gauge of the standing of the form. The second direction occurs sporadically in very different groups. It consists in an absorption of the branches of the Radius, so that their normal number is diminished. It is probably reminiscent of what has taken place on the hind wings, as we see from *Hepialus*. When we apply our knowledge of these two tests of specialization to the Day-Butterflies, we find that the second, or sporadic direction, occurs in the Parnassidæ, Pieridæ, Lycænidæ, thus independently in otherwise very different groups. It is thus a secondary character and we find it again in a group so dissimilar to the Day Butterflies as the Saturniades, while it is not indicated in the Hawk Moths. The first or general direction of specialization we find indicated by most Lepidoptera, in some of its stages. It is a fundamental movement and has probably a mechanical cause. The Pieridæ unite the two directions in a palpable manner, more strongly so than the Lycænidæ, which exhibit, in the Theclinæ, the second direction very completely. In the Pierinæ (*Mancipium*, *Pieris*, etc.) the first direction is shown by the transfer of vein IV1, the upper branch of the Media, to the Radius. This state of affairs we find only again so strongly marked in *Nemeobius*. In the four-footed Butterflies the first direction, or suppression of the Media, asserts itself in the total degeneration of the crossvein; while the two upper branches of the Media are pulled towards the Radius, the cell opens completely. Thus the Media, as a system, ceases to exist. But in the Nymphalidæ, the upper branch of the Media does not become completely absorbed by the Radius, as in the Pieridæ, in which latter the cell is never so completely opened as in the former family. Again the *second* direction is not taken up at all by the brush-footed butterflies, the Radius remaining generalized, five-branched. Judging from the condition of the hind wings especially, the Agapetinæ and Limnadidæ are less specialized than the Nymphalidæ. The Libytheidæ overlap the more generalized Meadow-Browns. The neuration of the Libytheidæ is almost repeated by the Nemeobiidæ, which latter retain no essential wing characters of the Riodinidæ (Erycinidæ) or Lycænidæ. I tried to explain its position on the Lycænid branch by the view that the evolution of the neuration has taken a parallel direction to that of the Pieridæ and the four-footed Butterflies. On the neuration by itself we must, and I now do, exclude *Nemeobius* from the Lycænid branch. Its junction with this branch must remain

problematical. There are three patterns of the wings of Day Butterflies: the Papilionid, the Pieri-Nymphalid, the Lycæni-Hesperid. I cannot place *Nemeobius* satisfactorily because I am told it is a Lycænid while its wings are of the pattern of the Pieri-Nymphalids.

The plan of the Lycænid and Hesperid wing is identical. The first only differs from the latter, by the commencement of the absorption of the radial veins. It is, in my opinion, very improbable that the Lycænid and Hesperid wing should be separately evolved. The Lycænid wing is a continuation of the Hesperid and can be directly inferred from it. The process of absorption which divides *Lycæna* from *Hesperia*, makes a further step and produces *Thecla*. The morphological value of the stages is similar.

Although, from any limited study, the neuration appears as a whole fixed, it is not so; it has its flux, perhaps its reflux. A wider comparison brings this out already and it will bring it out more and more. The neuration has a present meaning which cannot be overlooked. To neglect or pass over its teaching, the conclusions we may derive from its variations, is to detract from the picture, to make this picture by so much an inaccurate one, of the present condition and the probable past and future of the organism. In the Lepidoptera, the veins which seem to be most stable are the main branches, the Radius and Cubitus. Perhaps the latter with its two branches is the more constant. The play is now with the Media and its system of branches. Even in so fast bound, so concrete a group as the Sphingidæ, where everything seems exhausted tending to a future development, where there is so little that is lax and pliable in any stage of the insect, the branches of the median system still shift, vein IV1 sometimes leaves the crossvein and appears attached to the Radius, while IV2 varies in its inclination to the Cubitus. So rigid and stark a neuration as we find in the Hawk Moths seems to defy the investigator and to tax his patience beyond its power. But finally even here something will be yielded to the diligent enquirer. He will be able on occasion at least to distinguish between the more generalized and the more specialized form and this through the veining of the wings. The wing of the Hawk Moths has assumed a certain stability from its meeting in a high degree the requirements of flight and holds fast to this pattern of veining in consequence.

The art of the student is exercised to seize upon what is disparate and bring these characters together into deeper harmony. No doubt, a record lies for us to read in the neuration of the wings; the difficulty lies in properly revealing it, in an adequate interpretation. What I

have called the "moving veins" appear to follow a still active law of development. Of the three primary veins, Radius, Cubitus and Media, the two main trunks have attained a certain fixity opposition through processes which have been carried on during an unmeasurable past. The criticism which our knowledge of the direction of the venation allows us of the recently published systems of classification is: that these are often founded on characters the relative value of which has not been ascertained, their recurring nature not taken into account. It is as though I had placed *Nemeobius* among the Pieridæ, because its pattern of venation demanded it, and then proceeded to erect a violent system upon such a basis after the fashion of Mr. Meyrick. But much better work will be done in working out all the variations in a single organ, endeavoring to bring out clearly the value of these variations and allowing the existing classificatory sequence, I might say the Linnéan sequence, as a rule, to stand. The work before us is still to make what is now difficult, easy. When we have reached this goal upon any point of our subject, there will arise plenty to take up the matter and display their penetration upon it further.

So we see that the principal gain from these studies is the attainment of a measure, a distinct register, of specialization. By it the groups and genera drop more naturally into their places. And these studies are critical of Mr. Meyrick's pretensions, who would arrange the Lepidoptera upon neuration but offers us a mass of incorrect figures, an impossible phylogeny and the proof positive that he has nowhere understood the movement of the veins. So, too, they reach classificators who blindly thrust the Swallowtails between the Blues and Hesperids, and they show that these also, have not even understood the conditions of the problem they assume to have solved with so much pomp of learning.

In Comstock's "Evolution and Taxonomy," to which work my indebtedness is very great, I find no distinct recognition of the two main directions of evolution in the wings as such, while there is everywhere apparent the laudable effort to correlate the changes with mechanical causes. The suppression of the Media is detailed on page 76. In this, my *first* direction, the movement of IV2 is thus discussed: "But in which direction would one expect the base of vein V2 to migrate? Occupying an intermediate position between radius and cubitus it may go either way. It is like a stream in the middle of a level plain, a trifle may change its course." The view taken by me is that there is a contest between Radius and Cubitus for the possession of the residue of the Media, after base and crossvein have degenerated. The two principal

veins are the residuary legatees of the branches of the Media, and the determining cause as to which shall succeed to the odd or middle branch lies in the habit of the insect in flight. The strengthening of the Radius implies a more sailing, that of the Cubitus a more hovering flight, with quicker up and down movement as in the Hawk Moths. Comstock distinctly regards the crossvein as established after base of Media has disappeared to hold the branches. I do not. The crossvein appears to me a residue which is next attacked after the base of Media has been absorbed. If the middle branch refuses to follow either Radius or Cubitus it falls away by want of a base of supply, as in *Lycæna* and *Hesperia*. (See "Evolution and Taxonomy," p. 70.) The axiom expressed by me: *The amount of the absorption is the measure of the specialization*, is intended to embody the leading principle which is to guide our pterogostic studies.* In the Pieridæ alone have I found both positions of IV2 expressed. While in *Leptidia* the position on secondaries is cubital, in all the rest of the genera it is radial. I follow Comstock's general view in considering this as here indicating dichotomy of descent and establish upon it a subfamily division.

To summarize the principal openings through which I have tried to carry the working theory of the evolution of the wings beyond what had been previously attained:

1. I try to show that the suppression of the Media is the result of a continuous movement which, after absorbing the connection of the system with the base of the wing and thoracic sources of supply, next disintegrates the crossvein and distributes the branches between Radius and Cubitus. It is probable that the crossvein is an old character, an adapted survival of a former system of crossveins.

2. That that part of the crossvein closing the cell, and lying between the median branches and either Radius or Cubitus, becomes functionally the base of the branches in their new auxiliary position after the disintegration of the central or connecting portion of the crossvein. Its former morphological character as a portion of the crossvein becomes gradually lost, the angles rounded off.

3. The absorption of the radius branches is sporadic on different lines of descent and is a reminiscent action of the absorption on the secondaries which has here already generally fully taken place and been

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*The inequality of the specializing movement has been recognized by me in various places: Die Saturniden, 11, etc. The correlation of flight with the portion of the middle branch of Media is endeavored to be established by me in the "Tagfalter," etc., pp. 4 and 5.

carried to its extreme. I try to show, in pursuance of this observation, that it is questionable whether we can believe that the corresponding simplification can be attained by the Radius of the primaries, from the different position and conditions of the two wings. It is also interfered with by the absorption of IV1. This proves the absorption of the Media to have commenced after the absorption of the radial veins on secondaries.

4. I try to show that the general movement is inaugurated with the secondaries and that these show its effects more plainly than the primaries in one and the same individual. We must logically expect this to be the case from the entire course and the resulting theory of the specialization as applied to the wings, and regard it as arising from mechanical causes.

To descend to the application of these conclusions to classification, I try to show:

1. That the position assigned by Scudder and Comstock (l. c. III,) to the Swallowtails, next above the Hesperidæ, cannot be maintained in view of the pattern of the wings. The wing pattern of the Hesperiadæ and Lycænidæ is really the same and the interpolation of the Papilionidæ at this point is a violent proceeding. Far better is the position assigned to the Papilionidæ by Chapman; best of all the placing of the Parnassi-Papilionidæ, in a linear series, at the commencement of the Day Butterflies. The longitudinal vein IX on primaries, being a subprimary vein offers a subprimary character for dichotomy. The wing of *Papilio* loses its generalized characters, by a gradual process of specialization, in *Parnassius*. The Parnassi-Papilionidæ differ by a "high" character, the loss of VIII on secondaries, from all the other butterflies. They are thus comparable with the Attacinæ, the most specialized of Moths.

2. I have shown the indissoluble nature of the alliance between the Parnassiidæ and Papilionidæ and that the former are more specialized and should "head the series." The similiarity in color between the Parnassians and Pierids is adventious and secondary.

3. I have shown that the Nymphalidæ retain the radius in a generalized condition. That the higher groups alone show a perfection on on the opening of the cell, but that the upper branch of the Media is not absorbed by the Radius (as in *Mancipium*, *Pieris*, *Nemeobius*) but retains generally its position on the crossvein at the extreme upper corner of the cell. I thus show that there is small ground, from the neuration, for any supremacy of the Nymphalidæ, still less of the Agapetidæ,

or Limnadidæ, which are distinctly less specialized than the Nymphalidæ proper. So that we see that the statement of the Editor of the Philadelphia "Check List," that, in his "opinion," the Nymphalidæ are "correctly placed at the head of the Rhopalocera" is not derived from what this writer elsewhere calls "scientific knowledge" or "science," but is plainly the result of an effort to get into good company. It is characteristic also of this sort of "opinion," that when we turn to the List itself we find it to "head" with the Limnadidæ, the most generalized of the four-footed Butterflies. The success of the Nymphalid branch in attaining a variety of forms and a vast array of species has been great, and this tends to our believing it to he so dominating. It is, however, lateral, not on the main line. In the accompanying diagram the opening of the cell has led me even to give the higher groups perhaps too exalted a position, but this is a minor point. The connection of the Charaxini, a foreign group, with the main stem of the Nymphalidæ is problematical. I have commented on its position elsewhere, and it must be brought into place when the tropical butterflies are studied upon the basis here set forth.

4. It may be further assumed, that, in former periods of time, the grouping was laxer than to-day, and that the families we now are able to separate were once interconnected by forms which have dropped out. At that time the four or brush-footed butterflies may have been more nearly connected with the six-footed stem. From small and specialized groups we cannot expect the birth of new features, but from large and spreading assemblages, presenting a wide range of character. That such a state of affairs existed in the Whites, we have the testimony of *Leptidia* to prove. This butterfly appears now as an isolated survivor of what was probably a large group of Pieridæ. The abyss separating *Leptidia* from the Pierinæ is profound and I am informed that even more important deviations still exist in the family. The Pierids may then well represent the matrix from which the four-footed type proceeded.

5. Boisduval's groups of Suspensi, Succincti, Involuti, based on the fashion of fastening the chrysalis, have no existence as phylogenetic assemblages, hence are improperly used in this manner by Mr. Scudder. The Papilionid, Pierid and Lycænid Succincti have clearly reached the habit independently. It is a fallacy to believe, with Mr. Scudder, that there is a regular progression from the cocoon of the moths to a total absence of the use of silk. Instances are not rare where the generalized forms spin little or no silk and the specialized forms on the same phyloge-

netic line, make large and complex cocoons. This envelop to the pupa is so clearly an adaptive secondary character, that in one, single, upon all other characters, homogeneous group, like the Emperor Moths, the habit runs through the entire scale, from utter absence to a specialization hardly elsewhere attained, the hanging cocoons of *Philosamia*, *Attacus* and *Callosamia*. Only on paper does the sequence seen by Mr. Scudder exist. The specializations of the butterfly do not keep pace with Mr. Scudder's imaginary series, *Pieris* is more specialized than *Nymphalis*, and *Nymphalis* than *Oeneis*. The differences in the mode of attachment are brought by Mr. Scudder into an artificial connection. As to the "shrouds" of the Involuti, the utmost we can grant to Mr. Scudder is, that the mode of attachment in *Hesperia* may represent a stage by which the cocoon-making larva prepared itself to abandon this habit. To make more of the observation than this is to trifle. In a similar way the fact that in *Thais* the girdle has slipped up to the "nosehorn" may figure a stage between the Succincti and Suspensi. But *Parnassius* does not follow this lead. Among the Agapetidæ, *Oeneis* is a generalized form. The most specialized Satyrids, I have met with, are *Pararge* and *Lasiommata*. In these vein IV3 of the hind wings has effected its junction with the Cubitus. But in *Oeneis ællo* this junction is not attained and vein IV3 springs still form the cross vein as in the mass of the more generalized forms. *Oeneis* belongs evidently to the genera allied to *Erebia*, in which vein I is developed, curved and running to a point. Herein it departs from *Eumenis*, in which this vein is blunt as in the Pararginæ. The character of IV3 offered by *Oeneis* is important. It shows that this vein has not been fully absorbed by the system of the Cubitus, in this genus and the whole subfamily, Agapetinæ, to which *Oeneis* belongs. From a study of the imago, Mr. Scudder's classification is thus clearly to be rejected. The view that the Lycænid Succincti are specializations of the Papilionid is clearly an imaginary one.

6. The sequence in the above table is that recommended by me to be followed in catalogues and collections. The tribes are omitted because they are not sharply divisible. They are more or less lax groupings of allied genera near extensions of the generic idea. Each family or superfamily commences with the more specialized forms. To reverse this order in collections or catalogues is, I believe, impracticable from the nature of the objects here studied.

EXPLANATION OF DIAGRAM.

A. Papilionid stem (Papilionides) characterized by the presence on forewings of vein 'IX;' *B*, Hesperid stem (Hesperiades) characterized by the absence of the same vein. The titles of groups in *italics* denote that in these a reduction of the radial branches occurs (specialization through the *second* evolutionary movement). All the groups are arranged with regard to the specialization of the wing in the two principal directions. The *first* direction lies with the breaking up of the system of the Media and the final redistribution of the outlying three branches between the Radius and Cubitus, and this reaches a culminating point in the disintegration and disappearance of the cross vein (Nymphalinæ). In the Moths the same phenomenon is repeated in the Attacinæ (*Rothschildia, Samia, Philosamia, Callosamia, Attacus.*); IIa is the six-footed Pierid and main branch; IIb the four-footed (brush-footed) Nymphalid branch; both have the same essential wing pattern, or style of distribution of the veins and this is shared also by IIc, the Nemeobiid branch. IId is the Hesperid main branch; IIe the Lycænid specialized branch; IIf is the Hesperid generalized branch. The pattern of IId, *et seq.*, differs from the Pieri-Nymphalid branches by the simpler, more equidistant veining. The specialization, in the *first* direction, displays itself here by the disintegration of the cross-vein without a shifting of the outer branches, which latter remain *in situ*.

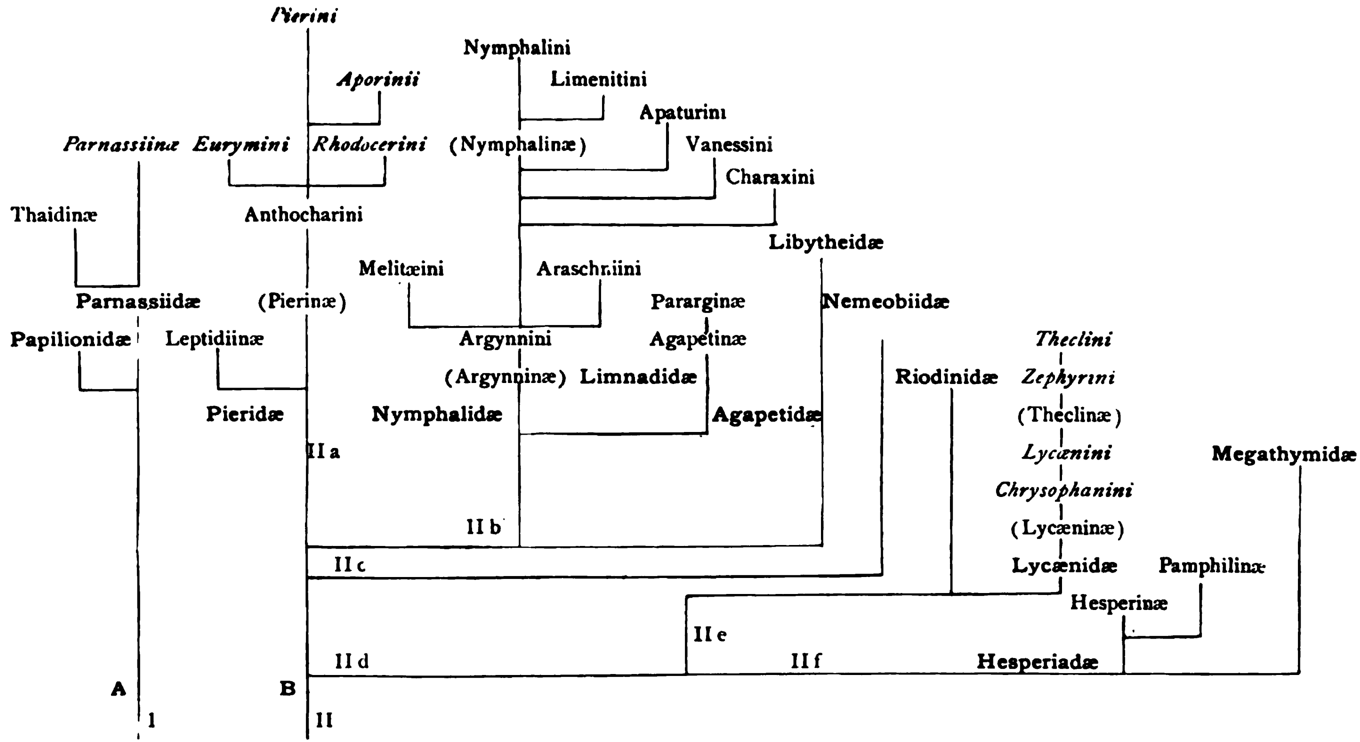
NOTES ON THE LARVA OF LAGOA PYXIDIFERA.

By HARRISON G. DYAR.

Since Abbot & Smith's work, in 1797, there has been no original reference to the larva in literature. It may be fitting that the one-hundredth anniversary of the discovery of the larva should be celebrated by a brief redescription, especially as Abbot & Smith's figure is somewhat erroneous and misleading. Their figure gives the impression of a longitudinally banded larva, whereas it is really uniformly colored. The larvæ occurred to me in some numbers at Miami, Florida.

Feet and warts, as usual in the genus, distinct; head retracted. Body slate gray; hair dense, concealing everything, regularly directed backward, soft, smooth, pale whitish gray with an under tint of darker gray which predominates narrowly along the subventral edge and in a disheveled anterior tuft above the hood. Dorsal line slightly keeled; anal hair short; no tufts. Anal plate reddish. In the earlier stages the hair is thin and fluffy, white; but the body shows through sordid whitish with a brownish dorsal band divided by a pale line and a broad brown lateral band. The spiracular glands show white. Edge of cervical shield and anal plate orange tinted. Cocoon and pupa as in *L. crispata*. Feeds on the young shoots of live oak. The larva differs from that of *L. crispata* only in color.

DIAGRAM OF THE PROPOSED DIPHYLETIC GENEALOGICAL TREE FOR THE HOLARCTIC DAY-BUTTERFLIES.



NEW SPECIES OF GEOMETRIDÆ FROM TROPICAL AMERICA.

By WILLIAM SCHAUS.

Hypnochlora olvidaria, sp. nov.

Body white. Wings white, covered with transverse striæ of a dull green, thicker in places and forming two transverse shades from the costal margin of the primaries to the inner margin of the secondaries. Expanse, 9 mm.

Habitat: Castro, Parana.

Comostola pallidaria, sp. nov.

Body yellowish white. Wings above white, thicky flecked with light green scales; fringes white, costal margin of the primaries white. A black discal point on primaries and secondaries. Underneath the wings are white. Expanse, 13 mm.

Habitat: Castro, Parana.

Racheospila arpata, sp. nov.

Head reddish. Thorax bright green. Abdomen whitish green, with a subdorsal row of reddish tufts. Wings bright green, with a reddish point, in the cells. The primaries with the outer margin purplish, wide at the inner angle, very narrow between 3 and 4, then widening slightly, and not continuing beyond 6, the fringe purplish. Secondaries with a large purplish spot, inwardly shaded with yellow at the apex; the anal angle also purplish and the fringe of the same color. Underneath greenish white, showing the markings of the upper surface. Expanse, 22 mm.

Habitat: Rio Janeiro.

Named after my friend, M. J. Arp, of Rio Janeiro.

Nemora masonaria, sp. nov.

Head brown. Thorax green. Abdomen dorsally brownish, laterally white. Wings white, thick irrorated with dark green striæ and scales; two indistinct very fine, wavy green lines cross both wings. Primaries with a small dark green discal spot. Underneath greenish white, the costal margin of the primaries finely brown. Expanse, 17 mm.

Habitat: Jalapa, Mexico.

I take pleasure in naming this species after J. T. Mason, Esq., who has kindly given me a specimen.

Aplodes fringillata, sp. nov.

Head thorax and abdomen white. Wings above bright green, the outer margins and fringes pearly white. A basal white spot on the primaries. An inner and a submarginal white line on both wings, between the latter and the extreme margin the veins are white. A white discal point on each wing. Two white spots on the inner margin of the primaries contiguous to the white lines. Underneath greenish white. Expanse, 15 mm.

Habitat: Castro, Parana.

Tachyphyle janeira, sp. nov.

Palpi white. Head, thorax and abdomen green. Wings above green, a smoky brown space occupying the base of both wings, except the costal margin of the primaries; an outer wavy dark line, heaviest on the primaries and outwardly shaded with luteous, crosses both wings, beyond which the nearly entire outer margin is black except the apex of the primaries and the anal half of the outer margin on the secondaries. A black discal point on each wing. Underneath nearly white, the outer margin of the primaries and the apex of the secondaries heavily shaded with black. A round black spot near the base of the primaries and a transverse basal black mark on the secondaries. Expanse, 31 mm.

Habitat: Rio Janeiro.

Azelina paranaria, sp. nov.

Antennæ pectinated, outer margins angular. Wings above pale reddish gray specked with black, the primaries with the space between the two lines reddish browny especially along the outer line. A round black discal spot on each wing. On the primaries the inner line extends from the costa, forming a deep curve close below the discal spot, and then two other large curves towards the inner margin, but not so deep as the first; the outer line wavy. Secondaries with only the outer line, which is nearly straight and shaded with brownish near the inner margin. Some termina, black points. Underneath the wings are greenish gray, with brown outer line finell wavy on the primaries, dentate on the secondaries, a dark annular discal spot on each wing. Expanse, 34 mm.

Habitat: Castro, Parana.

Nearest *Azelina lindigii* Feld.

Azelina jonesaria, sp. nov.

Wings very slightly dentate. Antennæ simple. Body and wings greyish brown. The primaries having the inner line wavy and oblique from the costa to the median at the origin of vein 2; the line recommences again at the median nearer the base, and forms an angle at the submedian. This line is outwardly shaded with very dark brown. The outer line is parallel with the outer margin, very slightly wavy with a deep indentation on the submedian vein. This line is inwardly shaded with rich brown, outwardly outlined finely with buff which is followed by a broad grayish shade, beyond which the margin is buff with a subterminal brownish shade. A terminal row of spots. The discal spot consisting of two small velvety brown contiguous spots one above the other and sometimes forming a line. Secondaries grayish brown. A submarginal buff line inwardly shaded with darker brown. Underneath dark fawn color, irrorated with black scales. A black discal point on the secondaries. An outer dentate whitish line. Expanse, 31 mm.

The ♀ differs in having the medial costal space of the primaries more light reddish brown, and the general ground color of the wings more of a gray. The terminal spots are yellow. Underneath the outer line is more angular and shaded with dark brown. Expanse, 34 mm.

Habitat: Castro, Parana.

Semiothisa paranaria, sp. nov.

Primaries excavated below apex. Secondaries with angle. Body and wings creamy buff, thinly speckled with brown. On the primaries a basal curved line light olive brown. An inner wavy brown shade on both wings followed on the primaries by another wavy olive brown shade. A minute cluster of brown scales at the origin of vein 2. An olive brown streak at the end of the cell. On the secondaries a black discal point. A broad greenish gray outer shade on both wings, narrowing near the apex on the primaries and cut by a brownish streak. The fringe buff except in the excavation below the apex where it is dark olive brown. Underneath yellowish buff with the markings as above, but the outer shade is more in the appearance of a band interrupted by the veins which are yellow. A whitish patch at the apex of the primaries. Expanse, 26 mm.

Habitat: Castro, Parana.

Semiothisa masonata, sp. nov.

Primaries with apex rounded and then excavated. Secondaries with an angle. Wings lilacine brown, the outer margin somewhat darker; the basal line slightly curved, fine brown. The inner line fine, nearly straight and contiguous on the primaries to a dark brown spot on the costal margin. The outer line first curved, then nearly straight till the secondaries, where it is very wavy, fine, brown, outwardly shaded with buff. Beyond the outer line a brown costal spot on the primaries, also a cluster of brown scales between veins 3 and 4. A black discal point on secondaries. Underneath yellowish, irrorated with brown. The basal and inner lines more heavily marked, the outer line very fine and followed by a more distinct brown line which is nearly straight and is outwardly rather heavily shaded with brown. Expanse, 26 mm.

Habitat: Jalapa, Mexico.

Epione cinerea, sp. nov.

Body and wings silvery brown gray, irrorated with black and white scales. Veins pale, distinct; an outer row of black points on the veins, connected by a fine brownish line, crosses both wings. The primaries with an indistinct white inner line, and a large black discal point, a subapical reddish brown shade. Underneath the markings less distinct, and the anterior portion of the outer line shaded with brown. A black discal point on the secondaries. Expanse, 28 mm.

Habitat: Rio Jalapa.

Acrosemia ochrolaria, sp. nov.

Head and thorax reddish. Abdomen yellowish brown. Wings reddish, both crossed by a wavy brown line, outwardly shaded with gray, which starts from a subapical gray spot on the costa of the primaries. A terminal brownish gray line partly dentate on the primaries, and forming a row of spots on the secondaries. A black discal point on each wing. On the primaries an inner transverse line, slightly curved, brown, inwardly shaded with gray. Underneath the wings are buff, the transverse lines smoky and most apparent on primaries. Expanse, 28 mm.

Habitat: Jalapa, Mexico.

Boarmia cariaria, sp. nov.

Pale grayish fawn color irrorated with dark striæ and specks, a basal curved black line not reaching the costal margin, a subbasal dark shade from the costa to the submedian vein; the median shade outwardly curved below the costa, and marked with a series of black points on each vein; this shade is closely followed by the outer line which is black and also marked with black points on each vein; beyond the outer line an indistinct brownish shade, and a subterminal wavy white line. On the secondaries the median shade and outer line are widely separated. A brownish spot at the end of the cell on both wings. Underneath the wings are yellowish white; on the primaries a terminal black shade widest at the apex, which is itself white; the costal margin of the primaries yellowish with fine black striæ. Expanse, 38 mm.

Habitat: Peru.

Described from a long series showing no variations, the species is closely allied to *B. roccaria* Obt.

Boarmia orizabaria, sp. nov.

Body gray. Wings white, thinly irrorated with black specks; the veins on the outer half of the wings yellow; some yellow shades at the base; the basal line fine, black; the median shade and outer lines black, indistinct on the primaries; on the secondaries the median shade is formed of two parallel bands and more conspicuous, the outer line is fine and well marked; a yellow shade follows the outer line on both wings; the apical portion of the primaries is blackish crossed by a wavy white subterminal line, the apex itself being gray. A broad subterminal black band on the secondaries. A large black spot in the cells. Underneath white; a black spot in each cell; a large black space on the apical portion of the primaries, leaving the apex white. On the secondaries, a few black marks on the outer margin below the apex. Expanse, 37 mm.

Habitat: Orizaba, Mexico.

This species is very distinct from any described form known to me. I possess a ♂ also quite similar but in poor condition.

Boarmia dukinfieldia, sp. nov.

Body gray; a black transverse line on the basal segment of the abdomen. Wings whitish, thickly irrorated with brownish scales, especially beyond the outer line. The basal line velvety black, very conspicuous; the median shade consisting of a fine brownish line rather indistinct except on the inner margin of the secondaries. A dark brown point in the cell; the outer line black, dentate and wavy, followed on the primaries at vein 4 by a dark shade extending towards the outer margin; the outer line followed by two brownish bands; a subterminal whitish wavy line on the primaries, the extreme margin distinctly outlined in black, the fringe white, spotted with black at the end of veins. Underneath the wings are dark gray, especially along the margins, and are crossed by an outer line marked with dark points in the veins. Expanse, 35 mm.

Habitat: Castro, Parana.

Boarmia sapulena, sp. nov.

♂ fawn color, thickly irrorated with brownish scales especially on the outer half of the wings, the basal line fine, blackish, indistinct; the median shade, dark, broad, indistinct, suffused with the ground color, the outer line fine, wavy, black, followed by a light brownish shade; an ill-defined smoky terminal band, divided by a semilunular white line. Abdomen with two dorsal rows of black spots. Underneath wings sordid white, faintly irrorated with brownish scales, and a faint dark subapical shade on the primaries and the discal spots indistinct. Expanse, 31 mm.

♀ Fawn color, thickly irrorated with brownish scales, no lines visible. A broad transverse median shade and the outer line replaced by a series of black points on the veins, followed by a faint browish shade. The discal spots very indistinct. Expanse, 42 mm.

Habitat: Petropolis, Rio Janeiro, San Paulo.

Boarmia luciaria, sp. nov.

Thorax brown. Abdomen gray. Primaries dark brown with the median space between the basal and outer lines light gray, these two lines black, well defined; a faint median brownish line, the discal spots brownish, circular, with grayish centre; an indistinct subterminal dentate blackish line inwardly powdered with grayish scales. Secondaries with the basal half light gray, crossed by a faint brownish median line, the outer line black, distinct; the marginal half dark brown with an indistinct subterminal grayish shade. A terminal row of black points. Underneath the wings are whitish at the base and then heavily shaded with black. Expanse, 32 mm.

Habitat: St. Lucia, B. W. I.

Boarmia aztecaria, sp. nov.

Head and thorax gray. Abdomen somewhat paler. Wings semi-diaphanous, whitish gray, slightly irrorated with darker gray and blackish striæ. Primaries with the base somewhat brownish; the basal line velvety black, oblique from costa to median, then slightly curved inwardly to the submedian and afterwards very oblique inwardly towards the base of the inner margin; a broad blackish sinuate median line extending on to the secondaries, where it curves down along the inner margin; the outer line velvety black and fine, starting from the costa at four-fifths from the base, obliquely curved to vein 5, where it shoots out a short black line towards the outer margin, and then wavy and sinuate to the middle of the inner margin, just above which it touches the median line; on the secondaries a wavy black outer line. The extreme margin finely black. The discal spots small and faintly marked. Underneath white, showing the markings of the upper side. Expanse, 42 mm.

Habitat: Orizaba and Oaxaca, Mexico.

A very fine and distinct species.

Boarmia franckia, sp. nov.

Wings fawn color irrorated with black scales, thickly so on the basal and median spaces. The basal and outer lines fine, black and parallel, very oblique outwards from the costa, and then angled and inwardly oblique to the inner margin;

the outer line followed on both wings by a brown band: the median shade dark, very dentate on the primaries; the discal spots small, black; on the outer margin some diffuse brown and whitish shades; the extreme margin finely black. Underneath pale fawn color irrorated with grayish scales; an indistinct outer row of points on the veins. Expanse, 39 mm.

Habitat: Castro, Parana.

Boarmia nebularia, sp. nov.

Wings pale fawn color, thickly irrorated with pale brownish scales; the lines very indistinct and represented rather by shades and heavier suffusion of scales; the outer line semilunular on the primaries, straight on the secondaries; a subterminal row of dark spots, more noticeable on the secondaries; a terminal row of black points. Underneath the wings are pale fawn color, thinly irrorated with brownish scales; a black point in the cells and a broad subterminal dark shade. Expanse, 35 mm.

Habitat: Petropolis, S. Brazil.

The sexes are quite similar.

ON THE TWO SPECIES OF EUDÆMONIA.

PLATES XI–XII.

BY WILLIAM BEUTENMULLER.

Several examples of *E. brachyura* and *E. argiphontes* and their larvæ, from Sierra Leone, Africa, are in the collection of Old World Heterocera of William Schaus, Esq., which was recently donated by him to the American Museum of Natural History.

Eudæmonia brachyura (Plate XI) is pink, with the spots yellowish. The larva is deep black on the upper side with the extreme sides broken with yellowish, and the under side wholly yellowish (possibly green in life). Anal plate with the two thorny spines, cervical shield and head testaceous. Along each side of the body are three rows of spines with branches of shorter spinules, on the anterior edge of the cervical shield are four short spines. Length 33 mm. Auggust 21, 1895. *E. argiphontes* (Plate XII) is brown with pinkish shades and a dark transverse band across each wing. The larva is yellowish (probably green in life), mottled with black along the sides, cervical shield, lateral row of spines and those on 1, 2, 3, 11 and 12 segments black. Remaining rows of spines yellow (green) tipped with black, with the spinules also tipped with black. On each side of the segments 3 and 4 is a black band broken on the dorsum by the ground color. Thoracic feet brown. Length 37 mm., July.

THE LIFE-HISTORIES OF THE NEW YORK SLUG CATERPILLARS.—XII.

PLATE IX, FIGS. 1–10.

BY HARRISON G. DYAR, A M., Ph.D.

Apoda biguttata *Packard.*

1864—*Limacodes biguttata* PACKARD, Proc. Ent. Soc. Phil. III, 341.
1865—*Limacodes tetraspilaris* WALKER, Cat. Brit. Mus. XXXII, 486.
1874—*Limacodes biguttata* STRETCH, Zyg. & Bomb. N. A. pl. 8, fig. 16.
1882—*Limacodes biguttata* GROTE, Check List.
1892—*Apoda biguttata* KIRBY, Cat. Lep. Het. I, p. 553.
1894—*Apoda biguttata* NEUMOGEN & DYAR, Journ. N. Y. Ent. Soc. II, 73.

LARVA.

1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 221 (as *A. y-inversa*).

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space broad, narrowing slightly toward the extremities, ending behind in the broadly quadrate joint 13, not strongly arched. Lateral space broad, oblique, scarcely concave, narrowing a little toward the extremities. Subventral space small, contracted. Ridges at first prominent and tubercular, setiferous, later smooth, granular, the subdorsal ridge formed only by the change in slope between back and sides. Setæ of Stage I single, on the thorax ia–iib and iv, on abdomen i-iii converted into tapering spines with expanded trifid tips, the upper two on joints 4–12 united into a single spine of which one seta forms a knot-like prominence on the other, exactly as in *A. y-inversa*. These setæ lean in alternating directions. Later the warts are represented by short setæ, normal in number, not united together; in the last stage almost entirely absent. Depressed spaces fairly well developed, small, but not very sharply defined, but all present (1)–(8). Skin at first smooth, later with secondary spines on the tubercles and conical granules, finally uniformly covered with round clear granules. After the last molt the specific white coloring definitely appears, of the same general character as *A. y-inversa*. There are six or seven stages. In the former case the stage before the last as here described is omitted.

AFFINITIES, HABITS, ETC.

This larva does not differ structurally from *A. y-inversa* with which it is strictly congeneric, and the same remarks will apply to both species. (See Journ. N. Y. Ent. Soc. III, 152.) In color it is the same whitish

green as its ally, but differs in the absence of the transverse yellow line on joint 3.

The eggs are laid singly on the lower branches of the oak, its only food plant. The larvæ feed in Stage I eating the parenchyma from below in little patches. The moths emerge at the end of June, my examples all appearing between the 25th and 29th of that month. The males separate from the females before morning and are not found in copulation during the day. The species is single brooded, mature larvæ occurring in the middle of August and into September.

This is the larva originally described by me as *A. y-inversa*. (See Journ. N. Y. Ent. Soc. III, 153 and V, 2.) I found them rarely at Plattsburgh, Clinton Co., and on Esopus Island in the Hudson River opposite Hyde Park, Dutchess Co. They were unusually abundant at Bellport, Long Island, in the summer of 1896 and I bred them in some numbers with the kind assistance of Mr. L. H. Joutel, who kept the cocoons over winter for me.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Elliptical, rather opaque whitish, white on both glass and leaf; 1.2 x .7 mm. Reticulations very small and obscure, irregularly quadrangular. They hatch in 7 to 8 days.

Stage I. (Plate IX, fig. 1.)—Distinctly segmented, opaquish white, the spines whiter. Rounded and narrowed behind, truncate before, highest in front. Dorsal and lateral spaces moderate, flat, not hollowed; ridges slight. No marks except a large black spot on the head, which consists of a patch of pigment below the skin of joint 2 and is visible even to the naked eye. Head smoky, especially on the vertex, the sutures of clypeus black; mouth brown, a pale area around it. When retracted, the head looks black. Setæ long, slender with broadened bases, tapering, the subdorsal row of joints 4–12 with distinct side prongs, one-third the length of the other limb. Tips enlarged and cleft. Basal two-thirds of seta milky white, apex transparent, smooth, becoming black. On joint 3 five setæ, the same on joint 4 but the upper two consolidated. The lateral seta of joint 5 leans upward and the subdorsals of joints 5, 7, 9 and 11 lean outward, alternating with the others. Two simple subdorsal setæ on joint 13. Skin smooth, slightly shining. Later the larva is very shiny, a hollow appears above the base of each subdorsal tubercle in the dorsal space and a distinct white line under the skin along subdorsal and lateral ridges. Spines no longer conspicuously white. Length .9–1.5 mm. The larvæ feed in this stage. Duration about 5 days.

Stage II. (Plate IX, fig. 2.)—Blunt, squarish, highest at joints 5–6. Pale green, a whitish line along subdorsal ridge, a little wavy. Subdorsal tubercles on joints 3–13 and middle ones on joints 3 and 4 conical, clear, with two black setæ each; lateral row on joints 3–12 with one seta, all with small, short, colorless, secondary setæ with blunt tips. Skin with sparse watery granules (Plate IX, fig. 6). Largest depressed spaces indicated. The primary setæ are conic and sharp tipped, the secondary ones bulbous. The dorsal space appears as a dark green band from the food showing by transparency. Length 1.5 to 2.5 mm.

Stage III.—Thickly conic, clear granular, otherwise as before. The dorsal depressed spaces show faintly as whitish dots. Subdorsal line more distinct, nearly straight; lateral tubercles setose. Head about .4 mm. wide, whitish, eye black, mouth brown. Length 2.4–3.5 mm. Duration 4 days.

Stage IV.—Elliptical with square tail. Dorsal space flat; lateral concave, subventral, short. Subdorsal ridge slight, lateral one well marked. No subdorsal tubercles, setæ arising from the ridge, two dark stiff ones on each segment with no secondary setæ. On the lateral ridge, low raised tubercles with some secondary setæ. Skin densely clear granular, the granules slightly conic. Color green, a yellow line along the subdorsal ridge on joints 3–13, not joining each other at either end. A distinct dorsal row (with dark centers) and a fainter lateral row of whitish intersegmental dots. Head .5 mm. wide, pale, eye black. Later the ad-dorsal depressed spaces are indicated, and a darker green shade appears above and below the subdorsal line. Length 3.5–4.6 mm.

Stage V.—Ridges even, not tubercular; skin densely clear granular, the granules large, conic, especially large along the lateral ridge, but no longer setiform. Setæ of both ridges black, arising from the ridge. Dorsal (1), addorsal (2), small ones below the ridge (3), large lateral (4), upper segmental (5) and lower inter-segmental (6) white dots, the two largest (1) and (4), dark centered, all these areas smoother than the skin between, lacking the granules in a small space, not much deepened, the edges graded and obscure. Body elliptical, tail quadrate, notched on the sides. Dorsal, and upper half of lateral space pigmented, green; below this transparent leaf green; a broad yellow subdorsal line on joints 3–13, dark edged above and below. The larva looks much smoother than before. Length 4.5–6.5 mm.

Stage VI.—Head about 1.3 mm., green, eye black. Body smooth, no setæ perceptible with a lens except the two pale ones of subventral row

(iv and v) which look long. Skin densely clear granular, the granules large, coarse, conic as before, but less sharply pointed and situated more closely along the lateral ridge. Tail quadrate, slightly laterally notched. Color whitish green, a broad yellow line along the subdorsal ridge, very slightly waved, edged with dark green as before. A faint white line along subventral edge. All the depressed spaces (1) to (6) indicated by yellowish dots, small, shallow, only (1) with a rather sharp edge and fine granular bottom, the others nearly covered by the large bordering granules. Subventral space very finely granular. Spiracles round, whitish, normal, in line. Later the color becomes gradually whiter, the subdorsal lines approach each other at the ends, but are separated by a space of .5 mm. No transverse line on joint 3. Length 6.3–9.5 mm. Duration of the stage 8 days.

Stage VII.—(Plate IX, fig. 8). Shape as described above. Skin closely clear granular, frosted. Whitish green, clearer on joints 3–5; broad subdorsal lines pale yellow, edged with dark green above and less distinctly so below; an obscure whitish subventral line. Subdorsal lines free at the ends. Depressed spaces whitish, not contrasting, (1) and (4) faintly dark centered. Granules rounded, not conic as before; not contiguous, but the sides a little angularly adapted to each other. Depressed spaces very small, the smallest, as (2), covered over by the granules which are a little smaller there than elsewhere. Space (1) a small elliptical smooth area. Setæ inperceptible. The shape is as in *A. y-inversa* except that the lateral ridge is more prominent, exceeding the subventral ridge. Length 9.5–12 mm.* Duration of the stage 7 days.

Cocoon and pupa as usual.

Food-plants.—Oak. Usually on *Q. alba*, less commonly on other oaks.

EXPLANATION OF PLATE IX.

Fig. 1. Larva in stage I, dorsal view, enlarged × 60.
" 2. Larva in stage II, side view, enlarged × 30.
" 3. Larva in stage VII, front view, enlarged.
" 4. The same, side view.
" 5. Moth of *Apoda biguttata*, natural size.
" 6. Granules of stage II, enlarged.
" 7. Larva in stage VII, early in the stage, dorsal view.
" 8. Larva in stage VII, mature.
" 9. Granules of stage V enlarged, from area of subdorsal ridge.
" 10. The same, stage VI.

* A larva with six stages had the following lengths: I, .9–1.5 mm., II, 1.5–2.4 mm., III, 2.4–3.6 mm., IV, 3.6–5.5 mm., V, 5.5–8.4 mm., VI, 8.0–11.2 mm.

DIPTERA FROM THE LOWER RIO GRANDE OR TAMAULIPAN REGION OF TEXAS.—I.

BY C. H. TYLER TOWNSEND.

The present paper is the first of a series to be published on the dipterous fauna of the region of the Lower Rio Grande, in Texas and Tamaulipas. The material described was collected by the writer, principally near Brownsville, Texas, while engaged as Field Agent of the Division of Entomology, of the U. S. Department of Agriculture.

The writer has already published, in the Transactions of the Texas Academy of Science, i, pp. 71 to 96, a paper on biogeography, which includes mention of the Lower Rio Grande district. This district forms a part of the *Tamaulipan* fauna, which may be recognized as extending from the Nueces river region in Texas to the central or southern part of the Mexican State of Vera Cruz. Several months' collecting done by the writer in the Lower Rio Nautla region of the State of Veracruz, since the above paper on biogeography was published, has shown that that locality must come within the limits of the *Tamaulipan* fauna, as possessing many temperate forms of insects. A considerable number of these temperate forms may range as far south as the Coatyocoalcos river, or even farther.

It is pointed out in the above mentioned paper that at best the insect fauna of Lower Rio Grande, from an examination of some 500 species of Coleoptera and Diptera, shows somewhat less than twenty-five per cent. of *Neotropical* forms. Probably the percentage will run lower on the examination of a greater mass of material. The district is mainly *Lower Sonoran;* but there is, beside the *Neotropical* (*Mexican* province of the *tropical transition* zone), a considerable element of *Austroriparian*, and even a few *Upper Sonoran* forms reach down to it from the west, while a maritime *Antillean* fauna reaches up the Mexican coast line and keys to Padre Island. The fauna of this district is therefore rich in forms, as particularly evidenced by the Coleoptera so far collected, for no less than five great life provinces tend here to meet and intermix their constituent elements to a greater or less extent.

For the determinations of the flowers on which the diptera mentioned in this paper were taken, I am indebted to Dr. J. M. Coulter and Mr. F. V. Coville.

SIMULIIDÆ.

Simulium tamaulipense, sp. nov.

♀. Length, 1½ mm. Near *S. meridionale*, but smaller and the outer one on

each side of the three thoracic lines not curved outward at posterior end. Eyes velvet black, face and front silvery; the front with usually a trace of a linear black vitta in one specimen very distinct, in another entirely wanting. Antennæ yellowish, with a silvery covering Thorax silvery, with three longitudinal lines; the middle one longest, very narrow and linear; the outer ones heavier, straight, slightly divergent posteriorly. Looked at from directly above, the outer lines appear curved, outwardly convex. Scutellum and metascutum below scutellum, both brownish in some lights, but in others they seem to be wholly silvery, the various portions appearing different in color to the view at the same time. Abdomen silvery, but the third and fourth segments wholly brownish, sometimes with a round median silvery spot on each. Legs yellowish, shaded with silvery, tarsi blackish or brownish; hind metatarsi yellowish, except at distal end. Wings clear, whitish, veins dilute pale yellowish. Halteres and wing bases pale dilute yellowish.

Four ♀'s, Reynosa, Tamaulipas. A small species taken on car windows of railway train, May 10th.

Described from four dried specimens.

SYRPHIDÆ.

Baccha clavata *Fab.*

One ♂ bred from pupa found in square of cotton at Carmen, about four miles up the river from Brownsville, May 24th. The pupa was fastened by its anal end to the inside of the square. It may be described as follows:

Pupa.—Length, 5⅔ mm. Pale greenish yellowish. Oval with a flat ventral surface, full and rounded on anterior end, more tapering and pointed on posterior end. A few short hair-like filaments of in, tegument on dorsal surface in five transverse rows, the first row being on anterior end above cephalic plate.

The adult was found issued May 31st. Facial stripe greenish black. Thorax dark metallic greenish. Scutellum greenish across the disk. Posterior border to the insertion of the antennæ dark greenish. Otherwise the coloring was normal.

Baccha tropicalis, sp. nov.

♂. Length, nearly or quite 12 mm. Eyes of a beautiful soft yellowish-olive color, frontal triangle rust-yellow except sides which are pale greenish-yellow, with a round or slightly oval black spot anteriorly near basis of antennæ, and a pointed spot before posterior angle. Front with thin black hair. Antennæ rust-yellow, the third joint with a brownish tinge, arista same color as third joint. Face pale greenish yellow. Ocellar area soft deep black, a brassy-yellowish space behind it between eyes. Occiput gray-cinereous. Thorax on the sides, and scutellum, the same color as the whole pluræ, bright clear yellow with hardly a greenish tinge, the scutellum and posterior sides of thorax with slightly more of a greenish or olivaceous tinge. Pectus

with a slight rosy tinge to the yellow. Disk of thorax abruptly rust-yellowish brown; with a narrow black vitta near border on each side, interrupted at suture and bordered on inside with a rust-yellow margin, but on outside with a hardly perceptible one between the vitta itself and the rust-yellowish brown line belonging to the ground color; in the middle with a pair of narrow uninterrupted vittæ, both narrowly margined inside and out with rust-yellow. Semicircular area below scutellum blackish, yellowish next scutellum. First segment of abdomen almost wholly yellow with a greenish tinge. (N. B.—The above description was made from fresh specimens just captured. What follows is drawn from dried specimens.) The colors change somewhat in dried specimens. Two broad blackish vittæ often appear on mesoscutum after specimens have become dried. The semicircular area of metathorax below scutellum is divided into two crescent-like portions, the lower one and lower half of upper being brown, and the rest yellowish. Abdomen yellowish-red or reddish-yellow, but I believe it is more of a rust-yellowish in fresh specimens, and certainly much lighter; first segment broad, lunate, with yellowish hairs; hind border of each segment darker, also base of second segment same except extreme base which is yellowish. Third, fourth and fifth segments with a median pair of narrow, closely approximated, longitudinal, parallel, brown lines. Legs yellow, the distal half of hind tibiæ brownish. Anterior-basal half of wings yellowish, extending on outer border distally to end of third costal cell, inner border of yellow thence extending back somewhat irregularly to middle or basal third of anal cell, except that it runs down the inner border of apical cell inside of spurious vein; inner-apical half, or rest of wing, dilute fuscous, the centers of the two posterior, anal, discal and submarginal cells being dilute or sub-clear. A wrinkle in distal end of second basal cell, extending into discal cell; three whitish spots in transverse line, one on proximal end of this wrinkle, one on spurious vein which is here slightly enlarged, and one opposite in marginal cell. Halteres yellowish, with a brownish tinge on knobs.

♀. Length, 11 mm. Differs from ♂ as follows: Eyes not contiguous. Rust yellowish of front extending back nearly to ocellar area, a narrow median blackish vitta on its posterior half. Posterior portion of front brassy-yellowish, narrowly enclosing ocellar area in front. Wings with the yellow as in ♂, but with no fuscous except at end of submarginal cell, very narrowly in end of marginal, on vein at distal end of anal cell, and faintly on small cross-vein. Abdomen with the two median lines on third to fifth segments heavier, with slightly oblique more or less faint brown lines on sides, and with lateral edges of third to sixth segments brown. Second segment pale brownish with a broad yellowish curved anteriorly convex fascia across middle. The ♀ has the abdomen wider than the ♂.

Nineteen specimens, as follows: One ♂ and two ♀'s, Brownsville, June 21. Taken on flowers of *Clematis drummondii* Torr. & Gray, and *Monarda clinopodioides* Gray. Nine ♂'s and five ♀'s, Brownsville, June 22. Taken on flowers of *Clematis drummondii*. Also one ♂ not on flowers. One ♂, Roch's Resaca, about three miles up the river from Brownsville, June 25. On flowers of *Clematis drummondii*, in opening of heavy timber—big trees with hanging moss.

Belongs to the neotropical group of *phæatoptera* Schin., *livida*

Schin., *flavipennis* Wied., etc., which occurs from Brazil to the tropical portions of Mexico.

Volucella esuriens, var. **mexicana** *Mcq.*

Brownsville, April 7. Ramirez and San Miguel, Tamaulipas, on the Matamoras and Monterey Railway, May 10th; and same date numbers seen hovering constantly about a large wood pile of well-seasoned mesquite near La Mesa, a wood stop west of Ramirez. They were probably seeking an opportunity to oviposit where their grubs could find longicorn larvæ on hatching from the egg.

San Tomas, about seven miles down the river from Brownsville, June 7. At this date this species was found extremely numerous in the palmetto thicket at San Tomas, but always flying high up amongst the tops of the palmetto (*Sabal mexicana*) moving very swiftly, and in such numbers making altogether a noise like a swarm of bees.

Brownsville, June 23. Two ♂'s and two ♀'s taken on flowers of *Gaillardia pulchella* Fong. Also taken up to July 14th.

Point Isabel, Texas, on the coast, June 29. One ♂ taken on flower of a composite near beach. This species ranges from the Texas and Mexican coast line at sea level to the table lands of the Northwest, reaching the top of San Francisco mountain in Arizona, nearly 13,000 ft. above the sea. It thus extends from the tropical to the boreal life-zones, which is an exceptionally wide range and one not often attained.

Eristalis furcatus *Wied.*

One ♂, Brownsville, June 24, on foliage. This species may be distinguished by its velvety black vittate thorax.

The present specimen has the spots on each side of second and third segments very distinct, of good size, and yellow, with a faint tinge of reddish brown on the hinder pair. There is no trace of the median whitish spot near the hind margin of second segment. Schiner (Nov. Reise, 362) has pointed out that this whitish spot is not visible in the ♂; the third and fourth segments have each a pair of metallic shining spots, separated by the median velvety black, which unites the anterior median triangular velvety black spot with posterior marginal fascia of the same color. The pale golden pile of frontal triangle is mixed with black pile posteriorly. Antennæ brownish yellow. Length, 9 mm.

This is a tropical species, ranging from Rio Janeiro and Argentina to tropical Mexico. It has been taken at an altitude of 6,000 feet at Amula in the mountains of Guerrero (Williston, Biol. C. A. Dipt., III, p. 62).

Eristalis tricolor *Jaenn.*

Thirty-three ♂'s and eight ♀'s, as follows: San Tomas, one ♂ June 16, and one ♀ June 23, in palmetto jungle. Brownsville, six ♂'s and one ♀ taken on flowers of *Lippia lanceolata* Michx, June 22; one ♂ taken on flowers of *Gaillardia pulchella* Fong, June 23; twenty-four ♂'s and six ♀'s taken on flowers of *Lippia lanceolata*, June 24; and one ♂, June 28.

The ♂ taken June 16 shows a very faint line of brown on posterior half of edge of second abdominal segment, and a still fainter trace on third segment. Face silvery-white, with whitish-brassy pile. Front a little cinereous, with longer hair of same color as that on face. Antennæ brownish yellow. Front and middle knees yellowish, extending half way down tibiæ, the rest of middle tibiæ yellowish brown, only the extreme proximal end of hind tibiæ yellowish. Wings very faintly flavous tinged on antero-basal position. Length, 10½ mm.

The other specimens measure from 8 to 11 mm. in length. They are all quite constant in abdominal coloration. All the ♀'s, however, and a very few of the ♂'s, show gradations to a variation (♀ of June 22) in which the black thoracic band is rather deeply invaded anteriorly in the middle by the cinereous, and also has an arcuate border of cinereous behind next the scutellum and entending to wing bases on each side. This makes the thorax wholly cinereous excepting a pronounced lunate band of black before hind margin, with its concavity forward. The scutellum is yellow as in other specimens.

Eristalis vinetorum *Fab.*

Brownsville, June 1, two specimens, ♂, ♀. One ♂ on flowers of *Verbesina encelioides* Benth & Hook., June 18. One ♂ on flowers of *Monarda clinopodioides* Gray, and two ♂'s on flowers of *Lippia lanceolata* Michx., June 22. Three ♂'s and four ♀'s taken on flowers of *Gaillardia pulchella* Fong. Also ♂, ♀, July 3. San Tomas, four ♂'s June 9 and 23, in palmetto jungle.

Length, 11 to 13 mm. All agree closely with Williston's description, except that the fourth abdominal segment in his specimens was a little retracted, thus hiding the opaque black transverse fascia on anterior border.

CONOPIDÆ.

Zodion albonotatum, sp. nov.

Two specimens; one, Brownsville, June 24; the other, woods back of Fort Brown, July 3. Both taken on flowers of *Lippia lanceolata* Michx.

Length, 7–8 mm. Differs from all described species by the whitish markings of the thorax. Face, cheeks and front light yellowish, covered with a silvery-white bloom; a little less than posterior half of front abruptly velvety dark brown or blackish, the anterior portion of front being more yellowish than the face. Antennæ brown, the tip of second joint often with a yellowish tinge, and the third joint with a reddish-brown tinge. Occiput fuscous or blackish, with some thin blackish hairs. Thorax and scutellum soft velvety brownish-black, with a medain pair of rather closely approximated ashy-whitish vittæ extending little more than half way or at most two-thirds way to scutellum, and with silvery-whitish pollinose spots as follows: A round one on humeri, a transversely elongate one just back of humeri cleft and widened below and notched anteriorly; the whole posterior border of scutellum, widest in the middle; and two rather rounded spots, forming really one longitudinally elongate marking but divided by a suture, immediately in front of each lateral corner of scutellum. First abdominal segment soft brownish-black, with a few black hairs on sides; second segment black on basal half on sides, but on only front border in middle, and with a pair of transversely elongate narrowly coalesced oval black spots near hind margin, the rest of middle portion of segment being of a shade between fuscous and golden yellow, the posterior half of sides broadly deep golden-yellow, pollinose continued narrowly along hind border, the black of anterior lateral angles of segment with a patch of black hairs; third segment wholly deep golden yellow pollinose, except a pair of large sub-lunate black spots rather deeply notched on outside, widened behind, reaching anterior margin, coalesced anteriorly, separated posteriorly by a golden-yellow median line running half way to front border, narrow hind border of whole segment golden-yellow; fourth and fifth segments wholly deep golden-yellow, except a pair of well-separated median black spots near hind margin, those on fourth segment being of good size, those on fifth small and dot-like; sixth segment wholly deep golden-yellow; two segments composing anus blackish, with a silvery sheen. Legs blackish brown, the whole with a considerable silvery sheen especially the under sides of tibiæ which are more yellowish, pulvilli and claws except the tips yellowish. Wings a little fuscous, the antero-basal half yellow. Halteres pale-yellowish. The black of abdomen has a slight olive tinge; and in old specimens the deep golden-yellow pollen sometimes becomes greased, and shows then only a blackish color.

TACHINIDÆ.

Ocyptera euchenor *Walk.*

Eleven specimens, Brownsville, as follows: One ♂, June 22, on flowers of *Lippia lanceolata* Michx. The front in this specimen was not fully developed, indicating recent issuance from pupa. Six ♂'s and four ♀'s, June 24, also on flowers of *Lippia lanceolata.*

Length of ♂'s 8–9 mm.; of ♀'s 8½–9 mm. Although there is only one millimeter difference in the length of the ♂'s, there is a marked difference in their comparative size and stoutness. Nearly all of the specimens have the prevailing color of the abdomen red, but one ♀ has it more black than red. Most of the specimens, including all

the ♀'s, have the tip of abdomen distinctly blackish, but several ♂'s have it more or less reddish.

Giglio-Tos makes this species a queried synonym of *O. dosiades* Walk. The specimens which I originally referred to *O. euchenor* (Pr. Ent. Soc. Wash., 1891) varied in length from 8–10 mm.; while those I referred to *O. dosiades* were not only much shorter, but proportionately much smaller in size, so that it seemed hardly probable that all belonged to one species. I am aware that size may be of no importance as a specific character, and since I have more recently found specimens of all gradations in size between the two forms, so that it was impossible to separate them into two series, I am inclined to believe in their identity. I advocate, however, the use of the name *euchenor*, instead of *dosiades* as used by Giglio-Tos, and this for the reason that the description of *euchenor* better applies to the normal specimens. Were we to take the name that comes first in the pagination of Walker's List, we would have to employ *epytus*, which is manifestly only a synonym of *euchenor*.

Jurinia apicifera *Walk.*

Eight specimens, Brownsville, as follows: Two, ♂, ♀, June 21; one ♂, June 22, and four ♀'s, June 24, taken on flowers of *Lippia lanceolata* Michx.; and one ♂, June 28. Length, 11½–14 mm.

The species which I have always recognized as *apicifera* Walk. may be distinguished by the following characters: The front (except vitta), thorax and scutellum are characteristically brassy-yellowish (sometimes grayish-brassy) pollinose; the abdomen is shining black, the fourth segment being conspicuously silvery (or grayish-ashy) pollinose.

One of the specimens above mentioned (♂, June 24), in which the thorax and scutellum have become greased, shows the ground color of the disc of thorax to be opaque black, while the humeri and lateral margins are tawny-yellowish, and the whole scutellum is brownish-yellow.

This species has the frontal vitta of a soft brick-yellow, sometimes ocher-yellow. The occiput is clothed with brassy-yellow hair of the same tinge as the pollen of thorax, sides of front, and scutellum. The whole face, including sides of face and usually most of cheeks, in these Brownsville specimens is pure silvery-white; while in northern specimens from Michigan it is usually very distinctly golden. I have already remarked on this peculiarity of difference between northern and southern specimens (Tr. Am. Ent. Soc., XXII, p. 70). There are four narrow

blackish vittæ on the thorax, all sub-equally separated from each other, the median pair being linear and more abbreviated behind than the others, which are more interrupted at the suture and curved inward behind. The hypopygium of the ♂'s is more or less reddish. The brassy pollen of thorax extends downward over the whole pleuræ, and on the underside of the front femora, in both sexes. The front tarsi of ♀ do not seem to be dilated. The scutellum bears three strong posteriorly appressed marginal bristles on each side, of which the middle one is the shortest; a short and weaker also appressed strongly decussate X-like pair in the middle on margin; and a shorter but sub-erect and straight pair immediately in front of the decussate ones. In the other points given by Williston (Trans. Am. Ent. Soc., 1888, p. 300), the specimens agree.

LOCALITY AND FOOD PLANT CATALOGUE OF MEXICAN COCCIDÆ.

BY C. H. TYLER TOWNSEND.

The following is a complete list, with full localities, distribution, and food plants, of all the scale insects so far identified from Mexico. The number, which in 1893 was but 18, now reaches 80, including varieties, and four species found at Brownsville, Texas, which must surely occur near Matamoros. The new species mentioned, have been described by Professor Cockerell in the Canadian Entomologist, Vol. XXIX, p. 265, who has recently worked up the last lot of material collected for the Department of Agriculture. That portion of the material collected between April 24 and May 10, 1896, in Yucatan, Campeche and Laguna, was secured while on a trip for the Department. The determinations of all the species of my own collecting have been made by Mr. Pergande and Professor Cockerell. Mr. Pergand determined most of the well-known species, while Professor Cockerell worked up new and less known forms.

Llaveia axinus *Llave.* (*a*) Halfway between Salina Cruz and Tehuantepec (Oaxaca). On unknown prickly bush, May 29, 1896. Coll. Towns. (*b*) Tlacotalpam (Vera Cruz). On *Jatropha* sp., and *Spondias* sp. Coll. by Llave.

Peculiar to Mexico. "I believe the genus *Llaveia* will prove to be identical with *Ortonia*, from Ecuador and Guatemala" (Ckll.).

Llaveia axinus, var. **dorsalis** Dugès. Mexico (exact locality not known to me). Coll. Dugès.

Peculiar to Mexico.

Icerya purchasi *Mark.* (*a*) Guaymas (Sonora). On orange, Sept. 23, 1894. Coll. Towns. (*b*) Hermosillo (Sonora). On orange, Sept. 25, 1894. Coll. Towns. (*c*) Magdalena (Sonora). On orange and lime, Sept. 26, 1894. Coll. Towns. (*d*) Victoria (Tamaulipas). On orange, Oct. 16, 1894. Coll. Towns. (*e*) Monterey (Nuevo Leon). On orange, Oct. 17, 1894. Coll. Towns.

Known elsewhere in California, Florida, Australia, New Zealand, South Africa, Sandwich Islands.

Icerya montserratensis *R. & H.* Izamal (Yucatan). On orange, April 28, 1896. Coll. Towns.

Known elsewhere in Montserrat Trinidad, Grenada.

Icerya pa meri *R. & H.* Guaymas (Sonora). On grape. Coll. Palmer.

Peculiar to Mexico. This species was described from cast larval skins, and may prove to be identical with some species more recently described.

Coccus cacti *L.* Southern Mexico. Formerly cultivated on *Opuntia*, in parts of southern Mexico, Oaxaca, Guerrero, etc.

Known elsewhere in Madeira, Canary Islands, Algeria, Spain, India, etc., where it was introduced for cultivation long ago. Also occurs in Jamaica.

Coccus tomentosus *Lam.* Guanajuato and Silao (Guanaj.) On *Opuntia* sp. Coll. Dugès.

Peculiar to Mexico.

Coccus confusus *Ckll.* var. La Puerta Rancho (Tamaulipas). In masses on *Opuntia* sp., May 6, 1895. Coll. Towns.

Known elsewhere in Texas, New Mexico, Arizona, Colorado. "The specimens are larger than the normal *confusus*" (Ckll.)

Capulinia sallei *Sign.* Mexico (exact locality unknown). On plant called "*capulino.*" Coll. Sallé probably.

Peculiar to Mexico.

Conchaspis angræci, var. **hibisci** *Ckll.* Tampico (Tamaulipas). On *Malvaviscus arboreus* called "*tulipan,*" October 14, 1894. Coll. Towns.

Peculiar to Mexico. The typical *C. angræci* is known only from Jamaica and Trinidad.

Conchaspis newsteadi *Ckll.* (sp. n.) Vera Cruz (Vera Cruz). On frangipanni, Feb. 26, 1896. Coll. Towns.

Peculiar to Mexico. "Surprising discovery! Three species of the genus are now known; *angræci* in Jamaica on an orchid (Hope Gardens), with the variety *hibisci* collected by Townsend in Tampico; another not yet published, found by Green in Ceylon; and now the third, this one found by Townsend in Vera Cruz. What the native country of the genus is, I know not. It may be oriental. I called this species after Mr. Newstead because he gave a very good illustrated account of the genus (as *Pseudinglisia*) only a few months after I published it." (Ckll.)

Eriococcus dubius *Ckll.*—Valles (Tamaulipas). On unknown plant, Oct. 13, 1894. Coll. Towns.

Peculiar to Mexico.

Phenacoccus yuccæ *Coq.* (*a*) Tlaltizapam (Morelos). On lime, Oct. 7, 1894. Coll. Towns. (*b*) Mexico (D. F.). On banana in sheltered patio, Dec. 27, 1892. On *Yucca* sp., probably *Y. filifera*, Oct. 8, 1894. Both coll. Towns. (*c*) Guadalajara (Jalisco). On orange, *Agave* sp., banana, *Yucca* sp., *Colocasia* sp., Oct. 9 and 10, 1894. Coll. Towns. (*d*) Agnas calientes (A. C.). On *Pelargonium* sp., *Amaryllis* sp., Oct. 11, 1894. Coll. Towns. (*e*) San Luis Potosi (S. L. P.). On orange, lime, cherimoya, *Lantana* sp., pomegranate, *Tacoma stans*, a malvaceous tree, and a caprifoliaceous shrub, Oct. 12, 1894. Coll. Towns. (*f*) Tampico (Tamaulipas). On orange, Oct. 14, 1894. Coll. Towns. (*g*) Las Esteros (Tamaulipas). On *Mimosa* sp., Oct. 15, 1894. Coll. Towns. (*h*) Monterey (Nuevo Leon). On fig, Oct. 17, 1894. Coll Towns. (*i*) Campeche (Camp.). On *Tecoma stans*, April 25, 1896. Coll Towns. (*j*) Progreso (Yucatan). On fig, May 16, 1896. Coll. Towns. Jalapa (Veracruz). On orange, May 19, 1896. Coll. Towns.

Peculiar to Mexico and California.

Phenacoccus helianthi *Ckll.* var. Northern Tamaulipas (probably). Occurs in Lower Rio Grande Valley. On cotton at Santa Maria, Texas, May 7, 1895. Coll. Towns.

Peculiar to Lower Rio Grande Valley. The typical form is found in southern New Mexico on sunflower.

Dactylopius citri *Boisd.* (*a*) Orizaba and (*b*) Cordova (Vera Cruz). On coffee. Coll. Segura. (*c*) Uruapan, (*d*) Ario, (*e*) Cuicatlan, (*f*) Jacona, (*g*) Tacambaro (Michoacan). On coffee. Coll. Segura.

Known elsewhere in eastern United States, Florida, Jamaica, Trinidad.

Dactylopius virgatus *Ckll.* Northern Tamaulipas (probably). Occurs in the Lower Rio Grande Valley. On *Cereus princeps*, guava, and *Abutilon holosericeum*, at Brownsville, Texas, June 1 to 17, 1895. Coll. Towns.

Known elsewhere only in Jamaica.

Dactylopius nipæ *Mask.* Jicaltepec (Vera Cruz). On guava, July 19, 1896. Coll. Towns.

Known elsewhere only in Demerara and Trinidad.

Dactylopius olivaceus *Ckll.* Cindad Porfirio Diaz (Coahuila). In cavities in leaves of *Yucca australis*, Nov. 25, 1894. Coll. Towns.

Peculiar to Mexico (so far as known, but doubtless occurs in Texas).

Dactylopius sonorensis *Ckll.* San Ignacio (Sonora). *Hymenoclea monogyra*, called "*gecota.*" Sept. 26, 1894. Coll. Towns.

Peculiar to Mexico.

Orthezia insignis *Dougl.* var. (*a*) Guadalajara (Jalisco). On orange, Oct. 9 and 10, 1894. Coll. Towns. (*b*) Agnas Calientes (A. C.). On lime, and (accidentally) tomato. Oct. 11, 1894. Coll. Towns. (*c*) Izamal (Yucatan). On chile, *Capsicum* sp., May 14, 1896. Coll. Towns. This may be either the true form or the variety. (*d*) Vera Cruz (Vera Cruz). Plant not given. May 7, 1893. Coll. Ckll. (*e*) Guanajuato (Guan.). Coll. Dugés.

Known elsewhere (typical form) in Jamaica, Trinidad, Antigua, Demerara, Ceylon.

Lecaniodiaspis radiatus *Ckll.* (sp. n.) Near Salina Cruz (Oaxaca). On plant resembling *Equisetum*, May 29, 1896. Coll. Towns.

Peculiar to Mexico. "This is the first record of the genus from Mexico. The species belongs in the subgenus *Prosopophora*, and is closely allied to others of the genus" (Ckll.).

Asterolecanium pustulans *Ckll.* (*a*) Pacific Coast of Mexico (locality unknown). On climbing plant. Coll. Craw, on plants entering port of San Francisco. (*b*) Vera Cruz (Vera Cruz). On potted plant, May 7, 1893. Coll. Ckll.

Known elsewhere in Florida, Jamaica, Montserrat, Antigua, Anguilla, Grenada, Demerara, Brazil, Sandwich Islands.

Tachardia mexicana *Comst.* Tampico (Tamaulipas). On *Mimosa* sp. Collector unknown; material found by Comstock in Museum Comparative Zoölogy.

Peculiar to Mexico.

Tachardia larreæ *Comst.* Northern Sonora (probably). On *Larrea tridentata.* Recorded by Comstock as occurring in southern Arizona and Mexico.

Peculiar to the *Larrea* region of southwestern Arizona and northern Sonora. *Tachardia* is a *Neotropical* genus entering the United States only in Arizona and New Mexico (and probably Texas).

Lichtensia lutea *Ckll.* Vera Cruz (Vera Cruz). On *Croton* sp., May 7, 1893. Coll. Ckll.

Peculiar to Mexico.

Pulvinaria camellicola *Sign.* (?). Tehuantepec City (Oaxaca). On *Ficus* sp., May 26, 1896. Coll. Towns.

Known elsewhere in Europe, New Zealand. As Professor Cockerell did not see these specimens they may be the same as his *P. simulans.*

Pulvinaria simulans *Ckll.* var. Northern Tamaulipas (probably). Occurs in the lower Rio Grande Valley. On a cultivated caprifoliaceous shrub at Brownsville, June 1, 1895. Coll. Towns.

Known elsewhere only in Georgia.

Pulvinaria simulans *Ckll.* Monterey (Nuevo Leon). On "fitolaca," which is another name for avocado pear, Oct. 17, 1894; and Oct. 1, 1895. Both coll. Towns.

Known elsewhere only in Trinidad (Port of Spain). Professor Cockerell says: "Nearer the Trinidad type, from which it hardly differs, than the Brownsville insect. It has 7-jointed antennæ, 3d joint longest, the rest subequal, 6 a little shorter, 2 a little longer than 1. Tarsal digitules filiform, digitules of claw short, bulbous at base, and with very large knobs."

Ceroplastodes niveus *Ckll.* Montezuma (Chihuahua). On spiny shrub, May 12, 1893. Coll. Ckll.

Peculiar to Mexico.

Ceroplastes irregularis *Ckll.* Montezuma (Chihuahua). On *Atriplex canescens*, May 12, 1893. Coll. Ckll.

Peculiar to Chihuahua and southern New Mexico.

Ceroplastes cistudiformis *Towns & Ckll.* Guanajuato (Guan.). On *Bignonia* sp. and *Chrysanthemum* sp. Coll. Dugés.

Peculiar to Mexico. Very near to *C. psidii*, Chav. which occurs in Brazil.

Ceroplastes cirripediformis *Comst.* (?) San Rafael (Vera Cruz). On *Castilloa elastica* (rubber tree), March 6, 1896.* Coll. Towns.

Known elsewhere in Jamaica, Florida.

Ceroplastes floridensis *Comst.* Balantam (Yucatan). On *Ficus* sp., May 10, 1896. Coll. Towns.

Known elsewhere in Florida, Louisiana, Jamaica, Barbadoes.

Ceroplastes mexicanus *Ckll.* (*a*) Guaymas (Sonora). On *Tecoma stans*, Sept. 24, 1894. Coll. Towns. (*b*) San Luis Potosi (S. L. P.). On *Tecoma stans*, Oct. 12, 1894. Coll. Towns. (*c*) Tehuantepec City (Oaxaca). On *Ficus* sp., May 26, 1896. Coll. Towns.

Peculiar to Mexico.

Ceroplastes ceriferus *Anders.* Cuantla (Morelos). On *Malvaviscus arboreus*, Oct. 7, 1894. Coll. Towns.

Known elsewhere in India, Japan, Australia, Antigua, probably Brazil. This determination was made by Professor Cockerell, who then considered the following species to be identical with *ceriferus*. It may, therefore, be the same form as the following, which was determined by Mr. Pergande, who holds the two to be distinct.

Ceroplastes dugesii *Towns.* (?) (*a*) San Rafael (Vera Cruz). On large tree with red bark, called "*chaco*" and "*palo mulato*," Feb. 29, 1896. Coll. Towns. (*b*) Guanajuato (Guan.). On *Malvaviscus arboreus* and *M. acerifolius*. Coll. Dugès.

Peculiar to Mexico.

Lecanium hemisphæricum *Targ.* Laguna, on Carmen Island (Campeche). On caprifoliaceous shrub (?), April 24, 1896. Coll. Towns.

Known elsewhere in Jamaica, Trinidad, Antigua, Montserrat, Pennsylvania, California, New Zealand, Australia, Europe.

Lecanium hesperidum *Linn.* (*a*) Tampico (Tamaulipas). On orange, Oct. 14, 1894. Coll. Towns. (*b*) San Luis Potosi (S. L. P.). On lime, Oct. 12, 1894. Coll. Towns. (*c*) Monterey (Nuevo Leon). On avocado pear, Oct. 17, 1894. Coll. Towns. (*d*) Chihuahua (Chih.). On orange in sheltered patios, Oct. 19, 1894. Coll. Towns.

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* I think this is a mistake made at the Dept. If I am not mistaken, I took this on avocado pear.—C. H. T. T.

(*e*) Nuevo Laredo (Tamaulipas). On guava and rose, Dec. 13, 1894. Coll. Towns. (*f*) Matamoros (Tamaulipas). On orange, June 1, 1895. Coll. Towns. (*g*) Izamal (Yucatan). On orange, April 28, 1896. Coll. Towns. (*h*) Vera Cruz (Vera Cruz). On rose, May 7, 1893. Coll. Ckll.

Known elsewhere in Europe, New York, Ohio, District Columbia, Georgia, Florida, Texas (Brownsville and Corpus Christi, Coll. Towns.), Utah, California, Jamaica, Trinidad, Sandwich Islands, Chili, New Zealand, Australia, South Africa. Concerning the material collected at Izamal, Yucatan, Prof. Cockerell says: "Is this species to all appearances, but material hardly adequate."

Lecanium oleæ *Bern.* (*a*) Agnas Calientes (A. C.). On oleander, *Pelargonium* sp. and plant called "*marguerita*," Oct. 11, 1894. Coll. Towns. (*b*) San Luis Potosi (S. L. P.). On orange, lime and *Tecoma stans*, Oct. 12, 1894. Coll. Towns. (*c*) Las Esteros (Tamaulipas). On *Mimosa* sp., Oct. 15, 1894. Coll. Towns. (*d*) Monterey (Nuevo Leon). On fig, Oct. 17, 1894. Coll. Towns. (*e*) Nuevo Laredo (Tamaulipas). On guava, Dec. 13, 1894. Coll. Towns.

Known elsewhere in Jamaica, Antigua, Trinidad, Florida, South Carolina, Texas (Brownsville and Corpus Christi, Coll. Towns.), California, Sandwich Islands, Japan, France, Australia, New Zealand.

Lecanium terminaliæ *Ckll.* Vera Cruz (Vera Cruz). On liliaceous plant, May 7, 1893. Coll. Ckll.

Known elsewhere only in Jamaica.

Lecanium schini *Ckll.* Guanajuato State. On *Schinus molle.* Coll. Dugés.

Peculiar to Mexico.

Lecanium imbricatum *Ckll.* Alta Mira (Tamaulipas). On *Mimosa* sp., Oct. 15, 1894. Coll. Towns.

Peculiar to Tamaulipas and the Lower Rio Grande Valley. Several specimens were found by me on cotton at San Tomas, near Brownsville, Texas, April 5, 1895.

Lecanium sallei *Sign.* Mexico (no exact locality). Plant unknown. Coll. Sallé.

Peculiar to Mexico.

Lecanium chilaspidis *Ckll.* (sp. n.). Tehuantepec City (Oaxaca). on *Chilaspis linearis*, May 26, 1896. Coll. Towns.

Peculiar to Mexico. This is a large species "Belongs to a typically *neotropical* series, and is a very distinct species" (*Ckll.*).

Lecanium perditum *Ckll.* (n. sp.). Xcolak (Yucatan). On *Ficus* sp., May 10, 1896. Coll. Towns.

Peculiar to Mexico. Professor Cockerell says: "This is a most interesting species, and must go in *Eulecanium*, a subgenus heretofore confined to the *Holarctic* region. It is very close in many respects to *L. antennatum*, Signoret, of the northeastern United States (on oak). At the same time, it indicates an approach from *Eulecanium* to the *neotropical* forms *L. batatæ*, Ckll. (Antigua, on roots of sweet potato), and *L. baccharidis*, Ckll. (Brazil, on *Baccharis*), two species, the relationships of which had heretofore been wholly obscure."

Lecanium, sp. n. (?) San Luis Potosi (S. L. P.). On pods of *Tecoma stans*, Oct. 12, 1894. Coll. Towns.

Peculiar to Mexico.

Leconopsis dugesii *Sign.* Mexico (probably Guanajuato). Plant unknown. Coll. Dugés.

Peculiar to Mexico.

Aspidiotus rapax *Comst.* Northern Tamaulipas (probably). Found in great numbers on oleander at Point Isabel, Texas, June 8, 1895. Coll. Towns.

Known elsewhere in Florida, New Mexico, California, Antigua.

Aspidiotus tricolor *Ckll.* (sp. n.). Near Salini Cruz (Oaxaca). On shrub not identified, May 29, 1896. Coll. Towns.

Peculiar to Mexico. "Very near to *A. rapax*, Comst., and *A. ulmi*, W. G. Johnson, but seems distinct. The three species constitute a little group. *A. ulmi* is from Illinois" (Ckll.).

Aspidiotus nerii *Bouche.* (*a*) Chihuahua (Chih.). On oleander, rose, olive, and tree called "*palo dulce*," Oct. 19, 1894. Coll. Towns. (*b*) Aguas Calientes (A. C.). On oleander and shrub called "*trueño*," Oct. 11, 1894. Coll. Towns. (*c*) San Luis Potosi (S. L. P.). on "*trueño*," Oct. 12, 1894. Coll. Towns. (*d*) Guadalajara (Jalisco). On *Yucca* sp., Oct. 9, 1894. Coll. Towns. (*e*) Matamoros (Tamaulipas). On *Melia azedarac*, June 6, 1895. Coll. Towns.

Known elsewhere in eastern United States, California, Honolulu, Australia.

Aspidiotus crawii *Ckll.* (sp. n.). Mexico (locality not known). On twigs said by owner to be sarsaparilla, but which are pronounced by both Craw and Cockerell to be grape vine. Coll. Craw on plants entering port of San Francisco.

Peculiar to Mexico. "Closely allied to *A. cydoniæ*, Comst." (Ckll.).

Aspidiotus perseæ *Comst.* Mazatlan (Sinaloa). On cocoanut palm. Coll. A. de Cima.

Known elsewhere only in Florida. "Attention should be drawn to the singular occurrence of Florida coccids on the Pacific coast of Mexico, the same not being found on the east slope so far as we know. The species are *Aspidiotus perseæ*, *Pseudoparlatoria parlatorioides* and *Comstockiella sabalis*—the last, however, represented by a variety, *mexicana*. So also to *Aspidiotus personatus* on the west slope and apparently not on the east slope, but common in the West Indies" (Ckll.).

Aspidiotus reniformis *Ckll.* (sp. n.). Tehuantepec City (Oaxaca). On leaves of *Ficus* sp., May 26, 1896. Coll. Towns.

Peculiar to Mexico. "Nearest to *A. perseæ*, Comst., but very distinct" (Ckll.).

Aspidiotus townsendi *Ckll.* Cindad Porfiro Diaz (Coahuila). On leaves of shade tree in plaza, Nov. 17, 1894. Coll. Towns.

Peculiar to Mexico (and probably Texas).

Aspidiotus nigropunctatus *Ckll.* San Luis Potosi (S. L. P.). On "*trueño*," Oct. 12, 1894. Coll. Towns.

Peculiar to Mexico.

Aspidiotus yuccæ *Ckll.* Cindad Porfirio Diaz (Coahuila), On *Yucca australis*, Nov. 25, 1894. Coll. Towns.

Peculiar to Mexico (and probably Texas).

Aspidiotus ficus *Ashm.* (*a*) Tampico (Tamaulipas). On orange and tangerine, Oct. 14, 1894. Coll. Towns.—(*b*) Chihuahua (Chih.). On "polo dulce," Oct. 19, 1894. Coll. Towns. (*c*) Matamoros (Tamaulipas). On orange, Dec. 9, 1894. Coll. Towns. (*d*) Laguna, on Carmen Island (Campeche). On orange and oleander, April 24, 1896. Coll. Towns. (*e*) Vera Cruz (Vera Cruz). On rose, May 7, 1893. Coll. Ckll.

Known elsewhere in Florida, Cuba, Jamaica, Texas (Brownsville, Coll. Towns.), Australia, Ceylon, Japan.

Aspidiotus scutiformis *Ckll.* (*a*) Victoria (Tamaulipas). On orange, Oct. 16, 1894. Coll. Towns. (*b*) Monterey (Nuevo Leon). On orange and pomegranate, Oct. 17, 1894. Coll. Towns. (*c*) Soledad (Vera Cruz). On avocado pear probably, May 8, 1893. Coll. Ckll.

Peculiar to Mexico.

Aspidiotus articulatus *Morg.* (*a*) Tampico (Tamaulipas.) On

orange, Oct. 14, 1896. Coll. Towns. (*b*) San Rafael (Vera Cruz). On orange, June 14, 1896. Coll. Towns. (*c*) Laguna, on Carmen Island (Campeche). On orange, April 24, 1896. Coll. Towns. (*d*) Izamal (Yucatan). On orange and cocoanut palm (on nuts), April 28, 1896. Coll. Towns. (*e*) Balantam (Yucatan). On *Ficus* sp., May 10, 1896. Coll. Towns. (*f*) Vera Cruz (Vera Cruz). On rose, May 7, 1893. Coll. Ckll.

Known elsewhere in Jamaica, Barbadoes, Nevis, Trinidad, Demerara.

Aspidiotus personatus *Comst.* Acapulco (Guerrero). On cocoanut palm. Coll. Craw on plants entering port of San Francisco.

Known elsewhere in Cuba, Jamaica, Barbadoes, Demerara. "It is singular that this species, so common in the West Indies, but seemingly wanting on the Gulf coast of Mexico, should now turn up on the Pacific side" (Ckll.).

Aspidiotus mimosæ *Comst.* Tampico (Tamaulipas). On *Mimosa* sp. Collector unknown; material found by Comstock in Museum Comparative Zoölogy.

Peculiar to Mexico.

Aspidiotus (sp. incert. off.) **perniciosus** *Comst.* Northern Tamaulipas (probably). Occurs abundantly in Lower Rio Grade Valley. On *Fraxinus viridis* var., at Brownsville, Texas, April to May 31, 1895. Coll. Towns.

Peculiar to Lower Rio Grande Valley. *A. perniciosus* is known in California, New Mexico, Florida, Virginia, eastern Maryland, Australia. "Does not look like *perniciosus* outwardly and surely must be distinct. though the microscopic characters of the ♀ agree so far as I can see" (Ckll.).

Aspidiotus, sp. nov. San Luis Potosi (S. L. P.). On avocado pear, Oct. 12, 1894. Coll. Towns.

Peculiar to Mexico.

Aspidiotus, sp. nov. (?). Hermosillo (Sonora). On tree called "*bagote*," probably *Parkinsonia* sp., Sept. 25, 1894. Coll. Towns.

Peculiar to Mexico.

Aspidiotus, sp. nov. (?). Monterey (Nuevo Leon). On rose, Oct. 17, 1894. Coll. Towns.

Peculiar to Mexico.

Aspidiotus, sp. nov. (?). Tehuantepec city (Oaxaca). On *Chilaspis linearis*, May 26, 1896. Coll. Towns.

Peculiar to Mexico.

Comstockiella sabalis, var. **mexicana** *Ckll.* Mazatlan (Sinaloa). On palms supposed to have come from this vicinity. Coll. Craw on plants entering port of San Francisco.

Peculiar to Mexico. The typical form, *C. sabalis* Comst., is known only from Florida.

Diaspis persimilis *Ckll.* (sp. nov.). Laguna, on Carmen Island. (Campache). On fruit of "*chicosapote*," April 24, 1896. Coll. Towns.

Peculiar to Mexico. "So near to *D. amygdali* (*lanatus*) that I had at first a notion to treat it as a geographichal race. Very interesting discovery, scientifically and economically" (Ckll.). *D. amigdali* is known in Jamaica, Grand Cayman, Santo Domingo, Barbadoes, Antigua, Martinique, Trinidad, Florida, Georgia, District of Columbia, California, Japan, Hong Kong, Ceylon, Australia, Cape Colony.

Diaspis cacti, var. **opuntiæ** *Ckll.* Xcolak (Yucatan). On *Opuntia* sp., May 10, 1896. Coll. Towns.

Known elsewhere only in Kingston, Jamaica. The variety *opunticola* Newst., is found in British Guiana; while the typical form *D. cacti* Comst., is a native of Arizona and New Mexico, but has been recently reported by Maskell to occur in India.

Aulacaspis rosæ Bouch. Chihuahua (Chih.). On rose, Oct. 19, 1894. Coll. Towns.

Known elsewhere in eastern United States, Europe, Jamaica, Demerara, California, Central America, Sandwich Islands, China, Australia, New Zealand.

Aulacaspis boisduvalii *Sign.* Alta Mira (Tamaulipas). On *Bromelia pinguin*, Oct. 15, 1894. Coll. Towns.

Known elsewhere in Jamaica, Barbaboes, Trinidad.

Pseudoparlatoria parlatorioides *Comst.* Acapulco (Guerrero). On cocoanut palm. Coll. Craw on plants entering port of San Francisco.

Known elsewhere only in Florida.

Parlatoria pergandei *Comst.* Matamoros (Tamaulipas). On orange, June 1, 1895. Coll. Towns.

Known elsewhere in Texas (Brownsville. Coll. Towns.), Florida.

Mytilaspis citricola *Pack.* or sp. nov. Tehauntepec City (Oaxaca). On *Chilaspis linearis*, May 26, 1896. Coll. Towns.

Known elsewhere (*M. citricola*) in Florida, California, Tahiti, Trinidad. "*Mytilaspis* sp. with the general appearance of *citricola*,

material inadequate. If it is not *citricola*, it certainly is not any of the known Mexican species. The group to which it belongs is a very critical one, and one must have good material" (Ckll.).

Mytilaspis gloverii *Pack.* (*a*) Tampico (Tamaulipas). On orange, Oct. 14, 1894. Coll. Towns. (*b*) Matamoros (Tamaulipas). On orange, Dec. 9, 1894, and June 1, 1895. Coll. Towns. (*c*) Laguna, on Carmen Island (Campeche). On orange, April 24, 1896. Coll. Towns. (*d*) Izamal (Yucatan). On orange, April 28, 1896. Coll. Towns. (*e*) Jalapa (Vera Cruz). On orange, May 19, 1896. Coll. Towns.

Known elsewhere in Louisiana, Florida, south Europe, Texas (Brownsville. Coll. Towns.), Bolivia (La Paz), California, Japan, Ceylon.

Mytilaspis philococcus *Ckll.* Guanajuato (Guan.). On cactus. Coll. Dugès.

Peculiar to Mexico.

Mytilaspis carinata *Ckll.* Acapulco (Guerrero). On "plants like *Anthurium*." Coll. Craw on plants entering port of San Francisco.

Peculiar to Mexico.

Howardia biclavis *Comst.* Southern Mexico. On lime. Coll. Craw on plants entering port of San Francisco.

Known elsewhere in Tahiti, Trinidad, Sandwich Islands, Ceylon.

Chionaspis citri *Comst.* (*a*) Tamipico (Tamaulipas). On orange and tangerine, Oct. 14, 1894. Coll. Towns. (*b*) San Rafael (Vera Cruz). On orange, June 19, 1896. Coll. Towns. (*c*) Laguna, on Carman Island (Campeche). On orange, April 24, 1896. Coll. Towns. (*d*) Izamal (Yucatan). On orange, April 28, 1896. Coll. Towns.

Known elsewhere in Louisiana, Cuba, Bermuda, Antigua, Trinidad, Demerara, Australia, New Zealand, Tonga, Japan, Samoa.

Chionaspis furfurus, var. **ulmi** *Ckll.* Northern Tamaulipas (probably). Occurs in Lower Rio Grande Valley. On *Ulmus crassifolia* in Brownsville, Texas, May 1, 1895. Coll. Towns.

Peculiar to Rio Grande Valley. *C. furfurus* Fitch. is known in Massachusetts, New York, Illinois, Maryland, southern California.

This ends the list of species so far known from Mexico. It should be stated that *Lecanium verrucosum* and *Dactylopius calceolariæ* have been erroneously recorded from Mexico.

Professor Cockerell's paper on Mexican Coccidæ, in 1893 (Ann. & Mag. Nat. Hist. Ser. 6, Vol. XII, pp. 47–53), brought the list of species and varieties then known up to 30, his paper having added 12 species. The early additions to the list are shown in the following table adapted from Cockerell:

Species known from Mexico before Signoret's time,	3
" added by Signoret (1873–75),	2
" " Comstock (1882–83),	3
" " Riley and Howard (1890)	2
" found by Dugès (up to 1893)	8
Total up to 1893,	18

In 1893, Cockerell found, on a trip through Mexico, 12 additional species, bringing the list up to 30. Since then the number has been increased by the writer, who found 19 additional species in 1894; 8 further additional in 1895; and 16 still further additional in 1896. In addition to these, Mr. Alexander Craw has found, up to 1897, in the course of his horticultural quarantine work at San Francisco, 7 more species, thus bringing the total up to 80 in all with the close of the year 1896. Therefore, in three years (1894, 1895 and 1896) the list of Mexican Coccidæ has been increased 50 species, and that during only a few weeks each year, probably not exceeding three months altogether, during which time much other work was also attended to. This indicates the surprising results to be obtained in collecting and investigating scale-insects in Mexico, Central America, and the West Indies, as well as South America, which is still less known in this respect. The writer is at present engaged in collecting further material in Mexico, and has a considerable number of species already which are doubtless additional to this list, but it will be some time before they can be worked up.

NEW SAWFLIES (TENTHREDININÆ) WITH DESCRIPTIONS OF LARVÆ.

By HARRISON G. DYAR, PH.D.

Siobla excavata *Norton.*

Antennæ short and thick, a little thickened before apex; posterior tibiæ not reaching apex of abdomen; eyes reaching almost to base of mandibles; labrum round, pointed; lanceolate cell with oblique cross

nervure; under wing with one middle cell or none. Black, coarsely granular and with a fine golden yellow pubescence. Head black, clypeus and labrum bright yellow, two basal joints of antennæ orange yellow, palpi pale. Thorax black, posterior edges of prothorax, cenchri, trochanters, basal two thirds of all tibiæ and apex of anterior femora yellow; tegulæ orange yellow; apex of tibiæ and tarsi light brown. Abdomen black, basal plates yellow, first segment brown centrally, each segment with a narrow posterior yellow line, the terminal segment half yellow; venter black. Wings faintly yellowish smoky, veins black, costa and stigma brown, the latter yellow at base; a black dot in the second submarginal cell. Length of male 10 mm., female 11 mm. *S. robusta* Kirby seems to be the same species. Larva characterized Can. Ent., XXVII, 339 as "5c."

Stage I.—Head .35 mm., brown-black, shiny; skin dark.

Stage II.—Head .53 mm., black, slightly pruinose. Body dull gray, scarcely darker dorsally except from the food showing by transparency; thoracic feet black; subventral region white; no spots.

Stage IV.—Head .9 mm., dark gray, body pruinose gray, brighter subventrally, annulate. No marks. Length 10 mm.

Stage V.—Head black except around the mouth, covered with white bloom; width 1.3 mm. Dorsal area faintly grayish, lateral black spots distinct, two on each segment; a series of small black spots subventrally along the bases of the feet, three on each segment. Subventral region yellowish, black points present; a white bloom.

Stage VI.—Head black, pale around the mouth; width 1.6 mm. Body as in the mature larva but the gray less evident, marks all smaller and fainter. A thick white bloom gradually appears.

Stage VII.—Head shining black with a faint white bloom; antennæ short, pointed; width 2.0 to 2.2 mm. Thoracic feet large, slender, divergent, abdominal ones small, present on joints 6 to 13. Segments 6-annulate with minute black points on the second and fourth annulets, a few others on the third annulet, stigmatal and subventral folds. Body pruinose leaden gray, a thin white bloom on a sordid greenish leaden ground; a series of diffuse, quadrate, black patches laterally, two on each segment between annulets 1–2 and 4–5. Upper subventral fold faintly yellowish, obscured by the bloom; lower fold black, forming a nearly continuous band. Subventral region white; feet and venter whitish; thoracic feet largely black. Solitary feeders, do not curl.

Stage VIII. (ultimate)—Head leaden black, but over the clypeus and below antennæ whitish; width 2.2 mm. Body annulate, shining, leaden

black throughout, no bloom; a series of large lateral patches, one on a segment, on joints 2 and 5–12 covering the spiracles, creamy yellow. These patches are as broad as the width of annulet 2 and posterior half of annulet 1. Thoracic feet leaden, clear at the joints; abdominal feet clear at tip. On attaining this stage the larvæ enter the earth.

Found commonly on the button bush (*Cephalanthus occidentalis*) around New York City early in June, a large and striking larva, often completely defoliating the plants of their young leaves. They all disappear by the middle of June and the flies do not appear till the following spring.

Macrophya trisyllaba *Say*.

Found by Mrs. Slosson at Franconia N. H., feeding on the elder (*Sambucus racemosa*).

Upper half of head black, lower white. Body segments 7-annulate with distinct white points on the second and fourth annulets. Dorsum to the spiracles black, mottled with sordid white principally in a festooned narrow subdorsal line and straight dorsal one. Below the spiracular line whitish with several small black spots on each segment and one on the base of the foot. Anal plate black. Thoracic feet pale with a mark at the base; abdominal feet on joints 6 to 13.

Ultimate stage.—Smooth, without points, shining waxy, the black coloration as before but paler, dotted with whitish and the creases of the annulets pale, hence the general appearance is paler than before. Head pale, eye black; a dusky shade over the vertex. The larvæ enter the ground to hibernate.

Mrs. Slosson sent me a few of these larvæ in September; the fly emerged the following spring:

Tenthredo atroviolacea *Norton*, var. **peratra**, var. nov.

Agreeing exactly with the description of *Tenthredopsis atroviolacea*, Norton, except that there is no white spot on the posterior coxæ and the third joint of antennæ is one and one-half times as long as the fourth. This is doubtless a variety of *T. atroviolacea*. The fly is entirely black, head, thorax and legs dull with large punctures, wings rather opaque violaceous, the venation of the posteriors as described for the male of *T. atroviolacea*. One male, bred from larva.

The larva is a very curious one. For a Tenthridinid remarkably specialized, having reached the stage of some Noctuid Lepidoptera (*e. g.*, *Pseudoglossa lubricalis* or *Cucullia artemisiæ*).

Looks a little flattened, but thick and robust. Feet on joints 6 to 13. Head round, dull black; width 1.4 mm. Body segments 7-annulate, the whole body soft dark gray, the ground color uniform. A

series of short thick papillæ, one on each annulet in subdorsal and lateral even regular rows, and other smaller ones scattered subventrally. First row (subdorsal), which is the shorter, has the papilla on annulet 1 orange, 2–4 black, 5–6 orange, 7th black; second row (lateral) which is larger, has 1st to 4th orange, 5th to seventh black; two behind the spiracle and two subventrally posteriorly pale orange; two groups of six to eight very small ones on the upper and lower subventral folds whitish. Sides with a number of small black spots. On thorax there are less of the papillæ, but the alternation in color is similar. Anal plate not differentiated.

Ultimate stage.—Smooth, very shiny, entirely dark slaty blue black, papillæ indicated by very small concolorous points. Thoracic feet pale. Enters the earth at once to form a moderately firm hibernating cell.

Sent me by Mrs. Slosson from Franconia, N. H., feeding on the elder.

Mogerus caryicolus, sp. nov.

Lanceolate cell petiolate, under wings without middle cells, but a distinct marginal vein in the male, none in the female; eyes rather distant from base of mandibles. Shining black, abdomen largely whitish.

Male.—Head black, clypeus emarginate and with the palpi white. Thorax black, posterior edge of prothorax, tegulæ, cenchri and all the sutures on the sides and below white; coxæ lined with black and white; legs luteous brown, base of tibiæ slightly marked with black, tarsi dusky. Basal plates of abdomen and extreme base of first segment black, the rest luteous above, sordid white on the sides, the tips of the segments faintly marked with subapical black lines; spiracles showing as black dots. Venter of abdomen darker, each segment broadly banded with black at the base, extending part way up the sides. Veins dark brown, stigma and costa pale luteous, shaded with brown at the margins. Wings clear.

Female.—Black above, clypeus white with brown tip, palpi pale. Thorax black, the middle and side lobes of mesothorax brown with a black central streak in each; posterior half of prothorax and tegulæ white; upper half of pleura brown; coxæ and trochanters marked with black and white. Abdomen black dorsally, sides and venter sordid greenish white, the posterior edges of all the segments with a fine white line; ovipositor sheaths blackish; spiracles black dotted. Length 6.5 mm.

There is some variation in color. Another female has the brown on thorax largely replaced by black, but the sutures on the sides distinctly marked in white as in the male. The abdomen is narrowly black banded below and the segments above are black only on the anterior portion. Costa and stigma pale.

I have placed this species in *Mogerus* on the characters of the male. The female is a *Blennocampa*.

Larva.—Head 1 mm., shining greenish white, eye in a black spot. Body green, faintly 5-annulate, with short Y-spines, all whitish, uniform.

Feet on joints 6–13. Thoracic feet colorless; dorsal vessel dark green, no marks. The spines are arranged three on second annulet, the upper one forked, the two lower simple and short; one small point low down on third annulet; three on fourth annulet, the two upper forked; two on each division of subventral fold, all simple, short.

Last stage.—No change. Head 1.3 mm. The head and thoracic feet seem a little greener than before.

Ultimate stage.—Smooth, waxy, scarcely shining, all pale whitish green, dorsal vessel dark. Segments indistinctly 3-annulate. Head concolorous with body, eye black; width 1.3 mm. Length 11 mm. The Y-spines are entirely absent.

Found on young hickory leaves at Fort Lee, N. J., during the last of May. Single brooded. This is doubtless the larva briefly described in Dr. Packard's 5th Report U. S. Entomological Commission, page 317, as "Selandria sp."

Harpiphorus maculatus *Norton.*

A specimen with three submarginal cells on one side and four on the other was bred from a larva on *Potentilla Canadensis* at Fort Lee, N. J. Head with a tiny brown spot behind the eye and dot at back of occiput on vertex. In ultimate stage head whitish, with a leaden patch on vertex. (See Can. Ent., XXVIII, 236.) The larva was intermediate between *H. maculatus* and *Monostegia ignota* in having but a trace of black spots on the head, and the imago was also intermediate in the number of submarginal cells.

Variety **coryli,** var. nov.

This larva is single brooded, disappearing before the middle of June. Found not uncommonly on the hazel at Plattsburg, N. Y., and VanCortlandt Park, New York City, in some cases rather destructive to the plants. I suppose this larva to represent a distinct species and referred to the larva as "5F" in Can. Ent., XXVII, 339. It differs in what seem good specific characters from the larva of *H. maculatus*, yet I do not find any differential points between the flies.

Solitary, usually out straight, sometimes curled, sitting on the under side of the leaf. Head faintly testaceous, a diffuse leaden black patch on the vertex behind; eye in a black spot; width 1.2 mm. The black spot reaches well down the side of the head, but the whole face is pale; a trace of white bloom. Thorax a little enlarged, abdomen scarcely tapering, slightly smaller posteriorly. Dorsum gray to spiracles, uniform or centrally dorsally on abdomen nearly white; sub-

ventral region white; a gentle white bloom; feet colorless. Segments 6-annulate. Joint 2 and the anal flap white. No points on the body and no spots.

Ultimate stage.—Head pale, pale silvery gray over the vertex. Body neatly 6-annulate, shining, dorsum pale greenish, silver gray ending above the tracheal line, brownish on joints 12–13; subventral region and legs pale, waxy greenish. Folds shaded with tarry brown. Spiracles dark.

Pontania robusta *Marlatt.*

No gall, but a portion of the leaf simply folded over. The egg is deposited under the lower epidermis near the edge, not far from the petiole. The larva eats little patches of the parenchyma on the under side scattering three-fourths of the way to the apex, apparently while the leaf is young; these patches are slightly swollen, discolored, pale, and as a result the outer fourth of the leaf folds back, neatly touching the surface, forming a hollow in which the larva lives. Finally the larva eats the whole leaf, emerging from its house and eating the apex of the leaf to return to the house again after feeding. The leaf is not rolled at all, simply folded. Fresh eggs were found May 9th. At that time the young leaf was neatly folded back though not fully grown. On expanding the folded part it was seen to be slightly larger than normal, forming a lobe on the leaf. The egg was situated under the lower epidermis, elliptical, white, .4 x .8 mm.

Stage I.—Head .35 mm. wide; all whitish translucent, the food showing by transparency. Head shining, body less so, the segments indistinctly 3-annulate; setæ fine, white, apparently a row on each annulet. Anal prongs colorless. Thoracic feet spreading. Length 1.5 mm.

Stage II.—Head .5 mm., pale brown, eye black, mouth brown. Body slender, colorless, translucent; segments irregularly 3-annulate, the first annulet flat, not bulging. Setæ whitish, very obscure. Anal segment somewhat swollen, prongs short. Feet on joints 6–11, 13.

Stage III.—Width of head .7 mm. As in the last stage. The apex of the leaf is not eaten, the larva still feeding on the parenchyma in a patch around the anterior edge of its house.

Stage IV.—Head 1 mm. The same. One was observed to emerge at the posterior end of the house near the petiole.

Stage V.—Head very pale brown, dotted, shining, eye narrowly black, jaws large, black, width 1.3 mm. Body shining, translucent,

slightly yellowish tinged with green, principally from the food. Segments 4-annulate, the fourth small, three rows of fine but rather long, colorless setæ on the first three annulets. Thoracic feet rather large, colorless; abdominal small, on joints 6–11, 13, colorless; short, blunt anal prongs, also colorless. No marks and the head is pale brown. The larva eats the whole leaf when it emerges, sitting on the edge, the body curled down a little on one side of the leaf. The larvæ will rasp with their prongs when in the houses if disturbed. At the end of the stage the larvæ enter the ground. Body all pale emerald green, the head brown. Anal prongs rudimentary, brownish, situated on the edge of the anal flap.

Found on the small leaved poplar (*Populus tremuloides*) at Fort Lee, N. J. I have also seen the characteristic houses on the poplar near New York City and at Jefferson, N. H. There is only one brood a year, the larvæ disappearing at the end of May or a little later. The houses remain on the tree much longer. Cocoons formed on the ground. The fly corresponds with Mr. Marlatt's description of the female; the male is not like his description.

Pontania pallicornis *Norton.*

With the habits of *P. robusta* but living on the willow. The smooth leaves are closely folded over, the house long on the narrow leaf, 25 to 40 mm., about one-fourth of the leaf turned over, so that the outer edge just reaches the midrib. The folded part at the angle where it is bent is slightly swollen and yellowish, caused by little scattered patches eaten from the under side.

Egg slits under the lower epidermis half way between the midrib and margin.

Stage I.—Head brownish, not black, width 2 mm. Body as in the next stage, small, colorless, whitish. The larva was seen sitting by the egg slit, no food in the alimentary canal and no marks of eating, yet a good folded house, the leaf swollen between the veins. This was a very young leaf.

Stage II.—Head shining blackish brown, nearly black; eye black; width, .3 mm. Body colorless, the food green by transparency.

Stage III.—Head brownish black, paler than before; width .4 mm. Body the same, but the anal end appears black from the contained frass, intensified by a black subdorsal patch which is now present. Prongs short, blunt, black.

Stage IV.—Head pale, dotted with brown over the vertex, a dark

brown trilobate patch on the clypeus, eye black; width .6 mm. Segments indistinctly annulate, rather coarsely two-ridged, showing on the subventral outline; on thorax only simply ridged; tubercles concolorous, setæ fine and pale. Subdorsal anal black patches preceded by a narrow transverse band; anal point black; body greenish.

Stage V.—Head pale brown, darker on the clypeus, eye black; width 1.2 mm. Thoracic feet rather large, colorless, abdominal ones moderate on joints 6–11, 13. Body transparent, green from food and slightly so from blood. Anal flap distinct; rounded, marked with a deep black subdorsal patch on each side. Points rudimentary, dark; tracheæ evident. The larva comes out the apex of the house and eats the whole leaf. Single brooded; the larvæ can be found till the middle of June. (Cocoons formed on the ground.) On the willow at Van Cortlandt Park, N. Y.

Pontania gracilis *Marlatt.*

Galls on the willow at Van Cortlandt Park, N. Y. City and also sent me by Dr. Lintner in numbers from Gouveneur, N. Y., on *Salix petiolata.*

Gall as described by Marlatt (U. S. Dept. Agr. Div. Ent., Tech. Ser. 3, p. 39), but not quite so large. Nearly spherical or a little elongated in the direction of the leaf, nearly evenly divided by the leaf, projecting half its width beyond the edge; single or rarely two on a leaf, situated near the petiole to one side of the midrib. Smooth, green, a few corky dots, very little red blush if any. Size 7 to 10 mm. in diameter. The shell is thin, containing a large hollow.

Stage III.—Head .5 mm., lower half white, vertex above black, eye smoky blackish, jaws brown. Body opaquish white, rather densely finely pilose; thoracic feet quite large, abdominal ones on joint 6 to 11 and 13, small. Anal end obliquely sloping, dusky shaded dorsally on joint 13. No prongs. The larva can move the body violently up and down.

Stage IV.—Head paler, dotted above; width .7 mm. Anal end round pointed from dorsal view with a few tiny dark specks. Body all opaquish white.

Stage V.—Head pale brown, sometimes with a blackish shade in clypeus and up from eye, eye black; width .85 to 1 mm. Body whitish colorless, segments 3-annulate with slightly watery shiny tubercles on each, not distinctly pilose, the setæ fine. A single, small, pointed, blackish minute tip to anal plate. The anal end is round pointed with a few dusky dots above.

When the galls are withered the larvæ emerge, colored uniformly whitish ash gray, and bore in soft wood to form their rather frail cocoons. There is but one brood in the year.

Pontania hyalina *Norton.*

Gall.—Mr. Marlatt gives a figure and description of the mature gall (Tech. ser. 3, U. S. Dept. Agr., Pl. Fig. 2, p. 37) in a place where the galls were numerous. As the eggs are laid only in the very young leaves and the species is polygoneutic, this necessarily happens in the case of the later broods, where only the few growing shoots are available for oviposition. Earlier in the season the galls are more scattered, usually but one on a leaf, generally remote from the petiole, but sometimes near or adjoining it. Situated between the midrib and the margin, rarely reaching the edge, never exceeding it. When the young leaf is just unrolled and still reddish, the egg is deposited by an elliptical cut below the epidermis on the under side, an inconspicuous puncture. As the leaf grows, the egg area enlarges by natural growth of the leaf, becoming also slightly thickened and surrounded by a bright crimson ring. This red ring later thickens faster than the central portion, producing the irregular shape of the mature gall. This is elliptical with irregular surface, especially below, evenly divided by the leaf, usually green or pinkish below, reddish or even brown and withered above, often black spotted; 8x5x6 mm. Some are very irregular below, grooved on one or both sides where crossed by the veinlets, thick, succulent and watery rather than fleshy, cavity small, elliptical, green inside. At maturity they are hollowed to a shell. The full grown larva eats a hole in the gall and escapes, leaving the empty gall on the tree where it may become the hiding place for other insects. A larva of Ichthyura was found in one. The galls are found on the trees at all stages at once, there being no regularity in the succession of broods. There appear to be five larval stages.

Egg.—Irregularly elliptical, smaller at one end, shining translucent white; .6 x .2 mm. Found in a gall which had attained the size of 4.5 x 2 mm. and consisted of an annular swelling with a central hole extending through the leaf. The egg was at one one side of the hole.

Stage II.—Head round, shining, dusky blackish; width .35 mm. Body uniform bright emerald green, segments 3-annulate, minutely setiferous; anal end slightly tapering, rounded. Thoracic feet large, abdominal ones very small, rudimentary, present on joints 6 to 11; all emerald green like the body.

Stage V.—Head leaden blackish, sutures of clypeus broadly pale. eye black; width .95 mm. Body yellowish green, darker from the shade of the alimentary canal, ill-defined wrinkly 3-annulate, minutely setiferous, no distinct tubercles. Anal end bluntly rounded, brown dotted above. Feet moderate, on joints 6 to 11; tracheal line evident.

At maturity the larva eats a hole in the gall, through which it pushes out the frass for some time before it is ready to leave the gall. Sometimes more than one hole is eaten or even an adjoining part of the leaf.

Cocoon.—Oval, brown, dense and opaque, sometimes formed between leaves on the tree or in a deserted gall.

Found on a large smooth-leaved willow tree at Bellport, Long Island.

Strongylogaster abnormis *Provancher.*

Larvæ found on knot weed (*Polygonum lapathifolium*) in New York City differed from those which I have previously recorded on *Rumex* (Trans. Am. Ent. Soc. XXII, 311), as follows: Head whitish with a light gray patch before the apex of each lobe; a brown patch in clypeus; a very slight bloom. Subventral folds slightly angulated and with the white points suggesting somewhat the appearance of *S. pinguis*, especially as the larvæ when occasionally sitting on the upper surface of the leaf may be somewhat sinuate. Anal segment green, concolorous with the rest.

Strongylogaster pinguis *Norton.*

Egg.—Under the upper epidermis in an irregularly elliptical area 1.7 x 1.4 mm., transparent, overlaid by the reticulations of the epidermal cells. Before hatching the larva swells up somewhat and a ring of air forms around it, appearing like a white margin.

The newly hatched larva has a width of head of about .3 mm., confirming my former observations, which I had doubted (Trans. Am. Ent. Soc., XXII, 308) and showing that there are probably seven stages instead of six. My descriptions, then, refer to stages I, II, IV–VII.

Found on black oak at Bellport, Long Island.

Acordulecera dorsalis *Say.*

The larvæ recorded in Can. Ent. XXVII, 340 as "6U" on hickory, proved to be not different from this species when raised to maturity. A number were found at Fort Lee, N. J., on pig nut hickory. I have also seen others in which the head was partly black and partly pale. The food plant was not the cause of the difference in color of the heads, as I have seen the black form also on the oak.

Lophyrus fabricii *Leach.*

Gregarius on pitch pine (*Pinus rigida*) at Bellport, Long Island, N. Y.

Stage before last.—Head blackish brown, shiny; width 1.5 mm. Body greenish white, a little shining, immaculate except for a faint, double, dusky suranal cloud; segments 6-annulate with minute points on the first, second and fourth. Thoracic feet black; abdominal ones present on joints 6 to 13.

Last stage.—Head round, higher than wide, smooth, shining brown-black; eye blacker; width 2 mm. Body slightly greenish, white, opaque. A broad, regular, sub-dorsal gray shade line on joints 2–13, rarely a narrow fainter dorsal one. A row of square black spots above the stigmatal line resting on the tracheæ, broken and partially disconnected by the annulets, one spot on a segment, covering annulets 2 and 4 on joints 3–12; a large, geminate, sooty black suranal patch. Subventral region white without marks. Thoracic feet black, except at the joints; abdominal on joints 6–13. Rarely the subdorsal shade is faint. The lateral spots vary somewhat, those on the thorax the smallest. Segments 6-annulate, 1st, 2d and 4th with a transverse row of minute black points.

When disturbed the whole brood will elevate the thoracic parts simultaneously.

Ultimate stage.—Head sordid whitish, shaded with black on the vertex, eye black. Body dull grayish, subventer waxy yellowish, a double dorsal, a broad lateral inky black, smoky band, cut by the incisures. Thoracic feet faintly blackish, banded. Anal flap broadly inky.

Cocoon.—Elliptical, dense but thin, light brown, single.

Eleven females bred from a single brood of larvæ, vary in the number of joints of antennæ. Seven have 16 joints, three 17 and one is intermediate, being very indistinctly 17-jointed. The specimens correspond with the description of *L. pini-rigidæ* Norton, which I consider a synonym of *fabricii.*

Eriocampa juglandis *Fitch.*

Head large, full at the vertex, nearly colorless, shining, a little yellowish, covered with a thick white bloom; eye black, mouth brown. Body appears dark, greenish or blackish gray, but when denuded of wool it is colorless, though darkly shaded from the contents of the alimentary canal; coarsely and deeply 6-annulate. The subventral

fold has some mealy bloom; dorsum covered with long tufts of white down which is secreted slowly after each molt, in long, flattened masses, two dorsal, two subdorsal, three lateral, the posterior one lower; subdorsal tufts longer than the unpaired dorsal ones. The wool may become 5 mm. long and curls a little. Three stages observed with widths of head 1.1, 1.5 and 2.1 mm.

Ultimate Stage.—Head 2.1 mm. Perfectly smooth, uniform opaque yellowish white, head shining and a shade darker, eye black. Segments indistinctly transversely wrinkled. Body robust, thick, as high as wide; thorax very slightly enlarged.

Food-Plant.—Butternut. Found at Greenwood Lake, N. J.

Dr. Packard has confounded this species with *Monophadnus caryæ* Norton (5th Rept. U. S. Ent. Comm., 339). Fitch's butternut larvæ, on being bred, prove to belong to *Eriocampa*, and moreover they differ from the hickory larvæ of Norton in being blackish, while the latter are described as greenish beneath the wool.

NOTES ON VARIOUS SPECIES OF COLEOPTERA.

PLATE X.

By F. W. WEBSTER.

It has always appeared to me as a good plan to record the little, detached observations that are made by almost every observing entomologist. Taken individually, these are very often almost devoid of scientific value, but we all of us know how much light some point, of itself unimportant, will throw upon the problem of a life history, when we attempt to work this out, or construct it from the known facts at our disposal. It is as if a huge piece of chinaware were to be dashed into an infinite number of fragments, and these scattered broadcast over the land, and the attempt then made to bring these fragments together, and from them construct the piece anew. It would probably occur that many pieces would have to await the discovery of one, and again, a piece would fit fairly well into the wrong place, and the error could only be detected by the right fragment finally turning up and indicating its proper place.

Some of these notes have been, in the main, recorded elsewhere, but without illustration; and it seems to me to be a matter of mutual benefit to have, somewhere, as accurate illustrations of as many of our species as possible.

My two specimens of *Odontæus filicornis* Say, a male and a female, were taken nearly twenty years ago in a small tract of woods, in northern Illinois, under a decaying log, and I think in late November.

My only specimen of *Tyloderma variegatum* (Horn) was taken in early spring, April, I believe, in an ant hill, located in grass land. It was in hibernation, doubtless, as *T. foveolatum* Say, breeds in the stems of the Evening Primrose, *Œnothera biennis*, and *T. fragariæ*, in the crown of the Strawberry. My *T. variegatum* is from Illinois and collected many years ago.

Lina scripta Fab., has increased in some places and become quite destructive to young willow and poplar trees, being especially troublesome in nurseries, where such trees are being grown. It has been found to be a matter of considerable difficulty to manage these insects, especially the adults, with insecticides, and hand picking was found expensive. The present year has witnessed a very material decrease in numbers of not only adults but in a marked degree among the larvæ. The cause of this was pointed out to me by an observing nurseryman, who was not an entomologist, and who stated that there were several other bugs that were destroying the young. On examination, I found these several so called bugs to be the several stages of development of the Spined Soldier Bug, *Podisus spinosus* Dallas. I have since noticed the very young larvæ of the bug, stationed about an egg cluster of the beetle and destroying the young as fast as they hatched, and also attacking much larger larvæ while these were feeding on the leaves. This year, the trouble by the beetle has been so slight as to obviate the necessity of using preventive and remedial measures against them.

Not unfrequently we have statements to the effect that insect larvæ can be killed by shaking them from the plants, in excessively hot weather, especially if the plants are growing in sand. As showing the possibilities in this direction, though I have never had much faith in it, I will say that during the terribly hot weather which occurred in this country about the first of August, while walking along the pavement, I saw an adult *Phytonomus punctatus* Fab., attempt to pass over a portion of the pavement composed of thick glass for the purpose of lighting the room beneath. The beetle had hardly touched the glass before it began to exhibit signs of distress, and ere it had passed over an inch of the glassy space it turned frantically about, but before it could escape from its torture it rolled over and died. The temperature at the time was above 100° Fah., on the sunny side of the walls of the buildings, as indicated by thermometers.

Our Coccinellidæ do not appear to have many Hymenopterous parasites. I have, however, the dried skin of a nearly fullgrown larva of *Coccinella 9-notata* Hbst., probably, punctured by several round holes, showing that a parasite had developed within and several individuals made their escape. Just what the parasite is, aside from its being a Hymenopter, I cannot conjecture, but the holes for escape are unmistakable. This was found at Painesville, Ohio, August 5th.

Valgus canaliculatus Fab., Plate X, Fig. 5. This has come to be a fruit tree pest in southern Ohio, where the adult works very serious injuries by eating out the fruit buds of the pear and other fruits, in spring. I can find little regarding this habit in our literature, the single instance of this injury being recorded in Insect Life, Vol. 1, p. 53, where Mr. W. W. Meech, Vineland, N. J., stated that the adult ate out the young buds of the quince. The larvæ are known to develop in decaying wood, and my assistant, Mr. Mally, has found the beetles hibernating under decaying stumps.

Crioceris asparagi Linn., is making its way slowly but steadily west and southwest into Ohio, seemingly spreading more rapidly in these directions than to the southward. There is hardly a doubt but that it has made its way through New York, and along the south shore of Lake Erie, between the lake and the Alleghany Mountains, broadening out in its area in northwestern Pennsylvania and northeastern Ohio. It now covers the area laying east of a line drawn from a point located some distance west of Cleveland, to near the point where Ohio, Pennsylvania and West Virginia corner upon each other, and the Ohio river ceases to form the boundary line between the two States and passes into Pennsylvania at this place. Professor A. D. Selby, Botanist of the Ohio Experiment Station, informs me that an introduced plant, the Golden Hawk-weed, *Hieracium aurantiacum* L., a native of the Alpine regions of Europe, and introduced into this country prior to 1818, without much doubt, is now apparently spreading over Ohio from western Pennsylvania in almost exactly the same way.

In regard to *Oberea bimaculata* Oliv., I have only to again call attention to a point already published, unillustrated,* in regard to the astonishing amount of excreta evacuated by the larvæ during the space of 24 hours. The adult is shown, slightly magnified, in Plate X, Fig. 1, the larva, also magnified at the left. These larvæ burrow out the center of the twig as shown in Plate X, Fig. 2, cutting out round holes

* Insects of the Year in Ohio, F. M. Webster and C. W. Mally, Bull. 9, New Ser., U. S. Dept. Agriculture, Division of Entomology, p. 43.

through the walls thus left, for the ejectment of the excreta. This excrement is shown at the right of Fig. 1, also enlarged, and falls down on the outside in more or less broken and detached masses. The larva is, when nearly full grown, certainly less than an inch in length, and the amount of these ejectments were so astonishing that I determined to get some definite idea of the exact amount. We had at the same time two larvæ under observation in the Insectary, one working in apple, the other in Witch Hazel, *Hamamelis virginiana*, and the castings of each were carefully saved during a period of twenty-four hours. In both cases the weight, 0.05 gram, was the same; and placed end to end, the detached pieces measured twenty-four and three-eighths inches in the one case, the other being too much broken to measure correctly, but probably did not differ materially from the first. This is giving an amount of evacuation for each hour from 11.00 a. m. to 11.00 a. m., the period of time covered by the test, amounting to considerably more in length per hour than the length of the larva itself.

Cyllene picta Drury, has come to have a fondness for Osage orange, *Maclura aurantiaca*, hardly second to that for the Hickory. From a section of Osage orange fence post, one and one-half feet in length and four inches in diameter, placed in the insectary, there emerged between February 4th and April 14th, twenty-seven individual adults, the greatest number to appear in a single day being four, on February 24th. The beetle is shown in Fig. 3, Plate X, while the closely allied species, *C. robiniæ* Forst, which breeds in *Robinia pseudacacia* L., is shown in Fig. 4.

To our knowledge of *Cryptorhynchus lapathi* Gyll., Plate X, Fig. 6, I have little to add, beyond what was given in Journal New York Entomological Society, Vol. V, p. 30. My specimens survived for a time, the last one having died the latter part of November. There was no indication of oviposition, and probably this does not take place until spring, the insect developing to the adult, largely at least, by September. The adults kept, fed daily by puncturing the bark of willow with which they were provided, gouging out the cambium layer. They simply make a hole the size of the beak, and then by circling about excavate a circular cavity under the outer bark. In Europe the species attacks *Salix cinerea*, *S. alba*, *Populus*, *Betula*, *Alnus*, and *Rumex hydrolapathum*, from which last it probably derived its specific name.

EXPLANATION OF PLATE X.

Fig. 1. Adult, larva, and excreta of the latter, of *Oberea bimaculata* Oliv.

Fig. 2. Section of twig burrowed out by *O. bimaculata*, showing holes in the walls for ejectment of the excreta of the larva.

Fig. 3. *Cyllene picta* Drury.
Fig. 4. *Cyllene robiniæ* Forst.
Fig. 5. *Valgus canaliculatus* Fab.
Fig. 6. *Cryptorhynchus lapathi* Gyll.

All figures are slightly enlarged, and drawn from nature by Miss Lydia M. Hart, under supervision.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF APRIL 20, 1897.

Held at the American Museum of Natural History.

Vice-President Dr. Love in the chair. Thirteen members present.

The Publication Committee reported that a lecture, by Prof. L. A. Best, had been given and called attention to the next by Dr. E. G. Love, to be held April 24th.

A vote of thanks was given to Professor Lyman A. Best for his lecture given before the Society.

Mr. Joutel spoke on the breeding habits of beetles. He stated that each species always worked in the same way, and that some larvæ live only on the sap that they cause to flow from their wounding the trees and so renders it impossible to raise them in the breeding box. He exhibited a collection of fifty species mostly Longicorns bred by him, among which were *Callidium antennatum*, four species of *Elaphidion*, *Heterachthes 4-maculatus*, *Phyton pallidum*, *Stenosphenus notatus*, *Cyllene pictus*, *X. colonus*, two species of *Euderces*, *Leptura emarginata*, *L. lineola*, *Cryptophorus verrucosus*, *Saperda puncticollis*, *moesta*, *discoidea* and *obliqua*, *Elasmocerus terminatus* and *Lixnea laticollis*.

Dr. H. G. Dyar spoke on the morphology of the abdominal legs of the Megalopygidæ. He showed that there were two sets of legs of different functions, first, the ordinary legs with hooks on abdominal segments 3 to 6 and 10, used for prehension, and second, a series of paired soft pads on segments 2–7 used as sucking disks for adhering to smooth surfaces. The structure is peculiar and proves interesting as leading up to the creeping disks of the Eucleidæ where the prehensile legs have disappeared and the disk is formed by an extension of these short pads.

Mr. R. L. Ditmars read a paper entitled "Spiders," in which he gave a short history of their classification and structure, together with a sketch of their habits and uses. He called attention to their poison glands and fangs and compared them with those of the poisonous snakes. He illustrated their webs and explained their mode of construction.

MEETING OF MAY 4, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Ten members present.

A vote thanks was given to Dr. E. G. Love for his lecture on the "Study of Insects and their Transformations," delivered on April 24th.

Prof. D. S. Martin spoke on insect inclusions in fossil resins. He stated that many years ago he was an insect collector and collected in what is now the heart of the city. He said the subject of fossil insects had been well studied in Europe, and that the resins and insects had been found in many geological epochs. The resins being an excellent preserving medium, the insects were usually in good condition.

Fossil resins begin to appear in the Cretaceous but insects are not found in them; it is only when we come to the Eocene that insects begin to appear in the resins. The resin is a product of *Pinus succinefera*. He gave a history of the formation and its distribution and said that the African resins are of the latest Tertiary or Quaternary, and are found near the equator, that copal is not so hard as amber, and that Zanzibar is very rich in insects, but that they have not been well studied. The Zanzibar gum is found thirty to forty miles from the present beach, and is from a tree called *Tricolobium zanzibariense* which still grows in Zanzibar, and as the tree is a beach lover, it shows that the sea has receded that much.

Fossil resins, he said, are also found at the Magdallen River in South America.

Professor Martin exhibited many specimens, which included beetles, flies, ants, and bees, some like the Termes (white ants) were like those still found in the West Indies. After discussion, adjournment.

MEETING OF MAY 18, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Fourteen members present.

The Auditing Committee reported the accounts of the Treasurer as correct.

Dr. G. H. Horn presented four of his recent papers on Coleoptera to the Society.

Mr. Beutenmüller exhibited a number of hybrid moths, among which were crosses between *Actias luna* and *selene*, *P. ceanothi* and *cecropia*, *P. gloveri* and *cecropia*, *P. gloveri* and *columbia*. He also showed the cocoons of the hybrids which partook of the characters of both parents.

Dr. Dyar gave a few notes on his studies of the larvæ of sawflies, and called attention to their large thoracic and small abdominal feet, just the opposite to the Lepidoptera. He said they were subject to dipterous and hymenopterous parasites in the same proportion as the Lepidoptera but of different species. He also spoke of the setæ and their arrangement, but had not carried his studies to completion.

Mrs. A. T. Slosson gave a few notes on her winter collections at Biscayne Bay and Miami, Florida, and said that the flora and fauna were entirely different to those of Lake Worth.

Dr. Prime gave a graphic description of the environs of Miami, Florida, and mentioned that there was a solid foundation of coral covered by vegetable mould in the hollows, and that the solid land extends along the coast in a strip about four miles wide, the bay being on one side and the everglades on the other; insect life is confined to this narrow strip and to the rows of keys that extend along the coast three to five miles from the main land. He gave an amusing example of landscape gardening around the hotel, which was to cut down every tree, shrub and bush to the ground, leaving a barren clearing surrounded by virgin forests.

Mr. Beutenmüller informed the Society of the sudden death of Mr. Martin L. Linell.

"Martin Larson Linell was born at Gronby, Sweden, June 24, 1849, and died suddenly May 3, 1897, of heart failure. He matriculated at the University of Lund, Sweden, in 1870. His father intended to fit him for the ministry, but he left the University at the end of his third year for the railway mail service. In 1879 he married and came to America, being employed first in a chemical laboratory in Brooklyn and afterwards becoming Curator of the Brooklyn Entomological Society. In 1888 he was appointed an aid in the Department of Insects in the United States National Museum, which position he held at the time of his death. He was an invaluable museum worker, and during his nine years in Washington he worked over and arranged a very large share of the collection, and had recently began describing all of the new coleoptera." A bibliography of his published writings will be printed in the Entomological News.

MEETING OF JUNE 21, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Ten members present.

The advisability of holding a field meeting on July 4th was discussed and left in the hands of the field committee for action.

Mr. Palm exhibited a number of moths from Arizona, amongst which was an unidentified cossid.

Mr. Munch showed a specimen of *Purpuricenus humeralis* var *axillaris* which he had bred.

MEETING OF OCTOBER 5, 1897.

Held at the American Museum of Natural History.

Vice-President Dr. Love in the chair. Eleven members present.

Mr. Beyer proposed for membership Mr. Charles Nushardt.

Mr. Joutel reported on the donations of insects for the auction sale by Mrs. Slosson, Messrs. Love, Seifert, Palm, Shoemaker, Ottolengui, Dyar, Cockerell, Doll, Münch, Joutel and Beutenmuller. A vote of thanks was given to all for their generous donations.

Prof. Cockerell communicated a note on the three species of *Xenoglossa*, found in New Mexico. He stated that these bees are commonly found in his locality and visit the flowers of *Cucurbita*, and that they are almost confined to this genus of flowers. *X. strenua* is described by him as *X. cucurbitarum*, but Mr. Fox stated that it agrees with Cresson's *Melissodes strenua*. It is, however, a true *Xenoglossa*.

Dr. Dyar spoke on the Pyromorphidæ found in New York, The family is a small one, allied to the Zygænidæ of Europe and more remotely to the Eucleidæ. There are three species in New York, *Harrisina americana*, *Acoloithus falsarius* and *Pyromorpha dimidiata*. The larva of the first is familiar, yet it needs further research, as there are two forms which may be different species. One form, described by Harris, is yellow with black warts; the other is banded with purple and has a white lateral line. The latter has not been bred recently. *Harrisina* is gregarious and feeds on the leaves of grape and woodbine. The larva supposed to be *Acoloithus*

is solitary, and feeds on grape, but rests on the withered portion of the leaf, with which its brown color harmonizes. A specimen of the larva of this species was shown. The larva of *Pyromorpha*, previously unknown, was discovered and bred last season. It is brown and feeds on dead leaves on the ground. The larvæ were bred on oak leaves, and some inflated specimens were shown.

Mr Beutenmuller said that he has found *Harrisina americana* on the leaves of Judas tree (*Cercis canadensis*) in Central Park, and found *Pyromorpha dimidiata* at Parkville, Long Island, amongst grass at the border of a dense woods, and that the insect was very local, being confined to only a short stretch of grass. The flight is short and soft, thus rendering it easy to capture.

Rev. Zabriskie showed *Phengodes plumosa* from Flatbush, Long Island, and *Phellopsis obcordata* from White Lake, N. Y., and also a borer, unknown to him, in the stems of currant.

Mr. Münch exhibited some beetles taken by him during the past season. Adjournment.

MEETING OF OCTOBER 16, 1897.

Held at the American Museum of Natural History.

Vice-President Dr. Love in the chair. Twelve members present.

Mr. Charles Nushardt was elected an active member. Mr. Beutenmuller proposed Mr. C. F. Hartman for active membership.

Mr. Beutenmuller gave some notes on the genus *Anthocharis*. He stated that this name had to be dropped in preference to the name *Euchloë*. This last name was proposed by Hübner (Verzeich. bek. Schmett., 1816) and the former by Boisduval (Spec. Gen., I, 1836, p. 556). He further stated that we had too many species in our list and that in long series of *sara* and the var. *reakirtii* which run from white to yellow, *stella* and *julia* could not be picked out. *Thoosa* Scudder is probably the same as *reakirtii* ♀ and the specimens in the Neumoegen collection from which descriptions were made by W. H. Edwards (Can. Ent., xi, p. 87) were without doubt the same as *reakirtii*, but the type in Scudder's collection must be examined to definitely settle this question. *Flora*, he thought was a small *reakirtii*, and *ausonides* certainly nothing more than a race of the European *ausonia*. Strecker so places the species in his catalogue. *Hyantis* is suspiciously close to *ausonides* and may prove to be the summer brood. All the specimens of *ausonides* in the Hy. Edwards' collection were taken from March to May and all the *hyantis* in July. *Rosa* is without much doubt a variety of *olympia*. *A. creusa*, *cethura*, *pima*, *lanceolata* and *genutia* are good species. *A. morrisonii* was not known to him.

It is our painful duty to herewith announce the death of Dr. George H. Horn, the well known and eminent coleopterist. He died at Philadelphia, Pa., November 25, 1897, in his fifty-eighth year of age.

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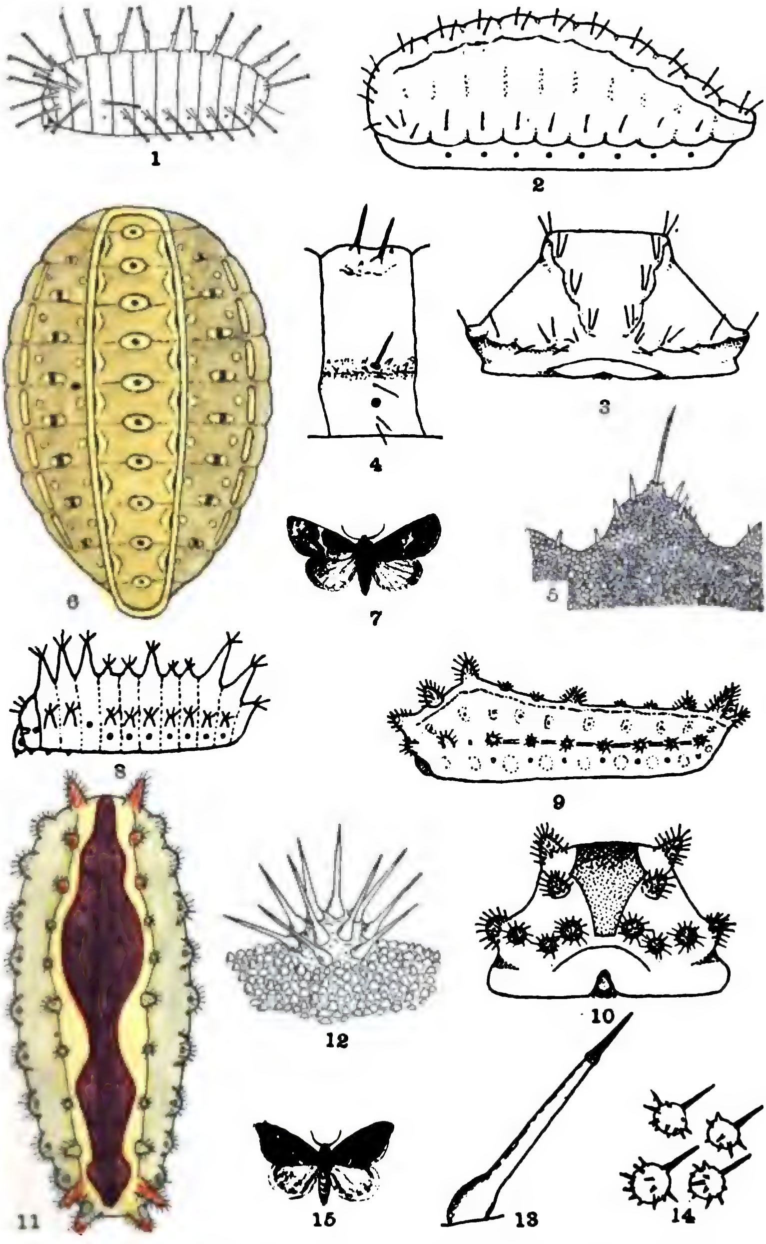
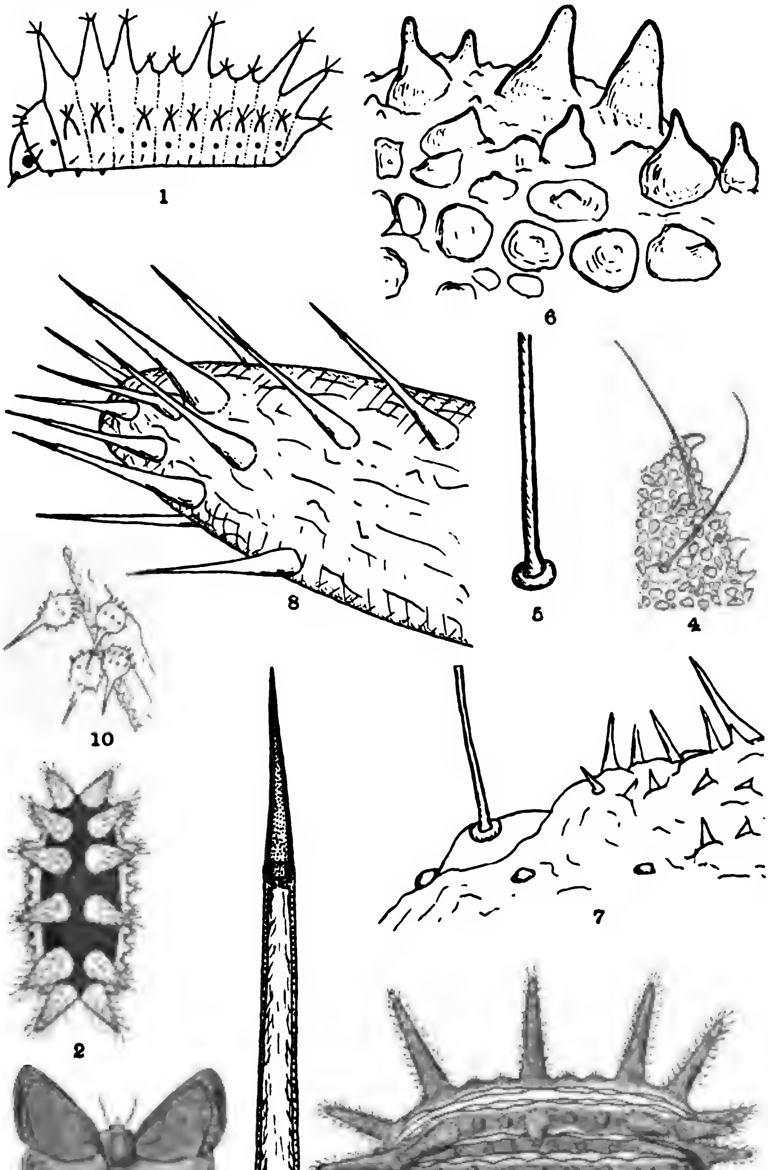


Life-Histories of Tortricidia fasciola and Adoneta spinuloides.



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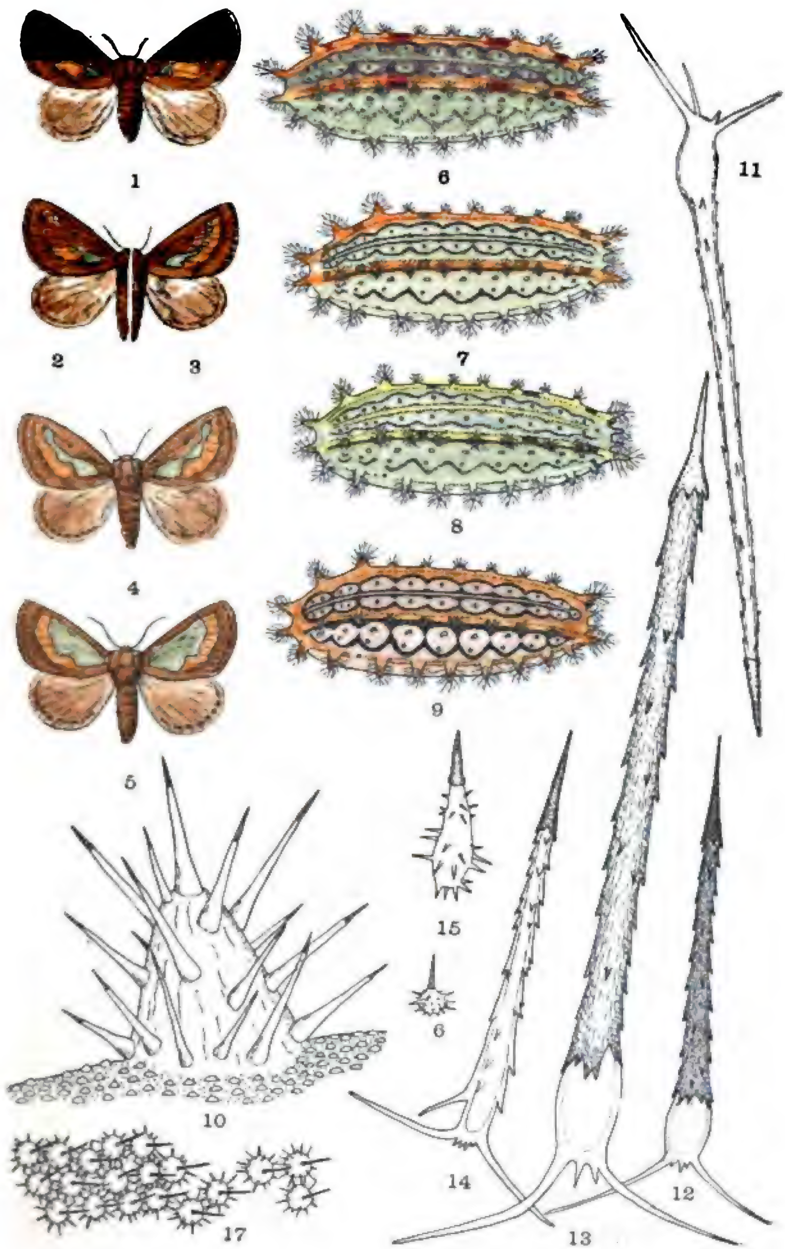
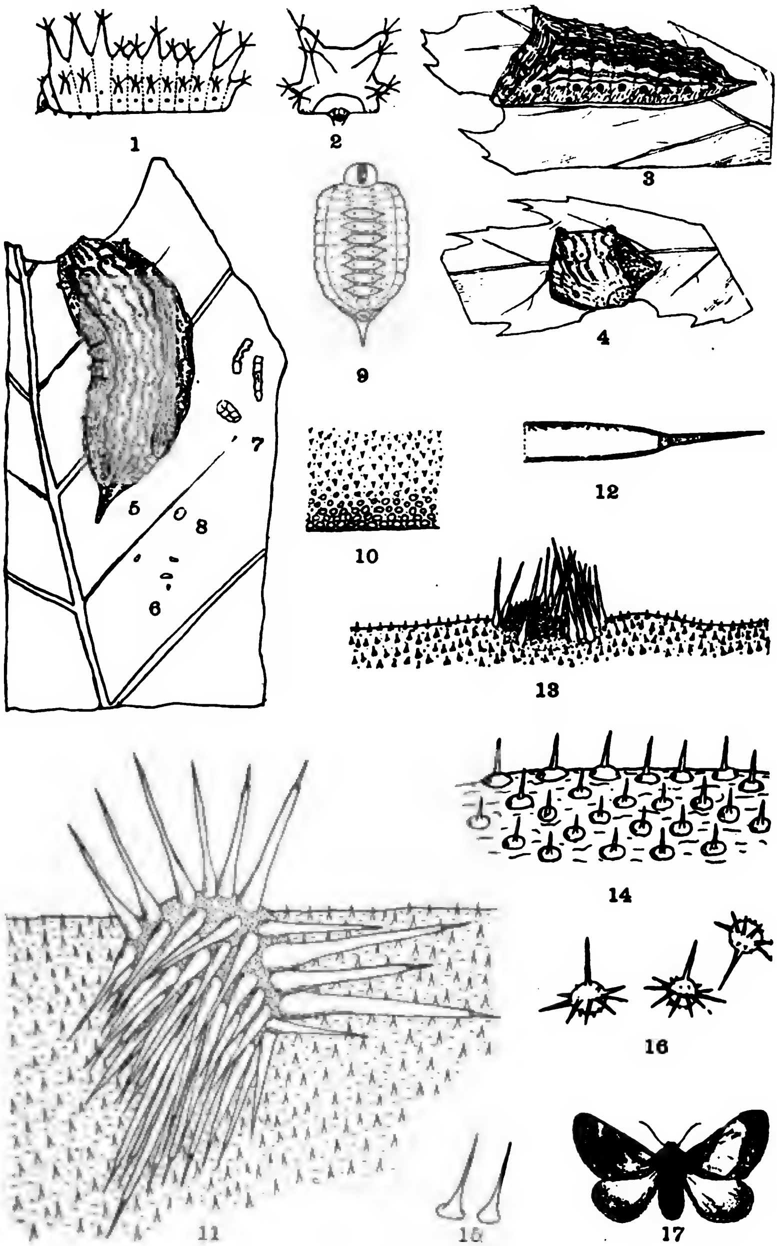


Life-History of Euclea delphinii.



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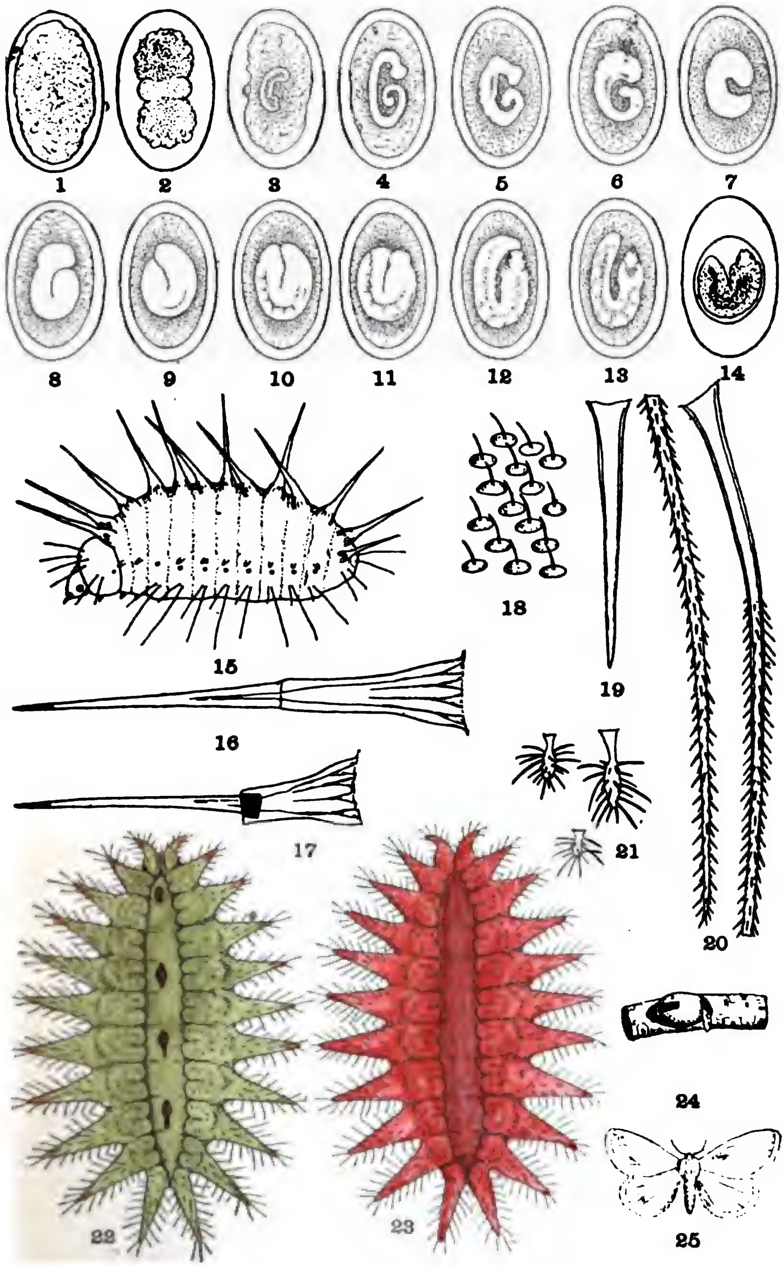
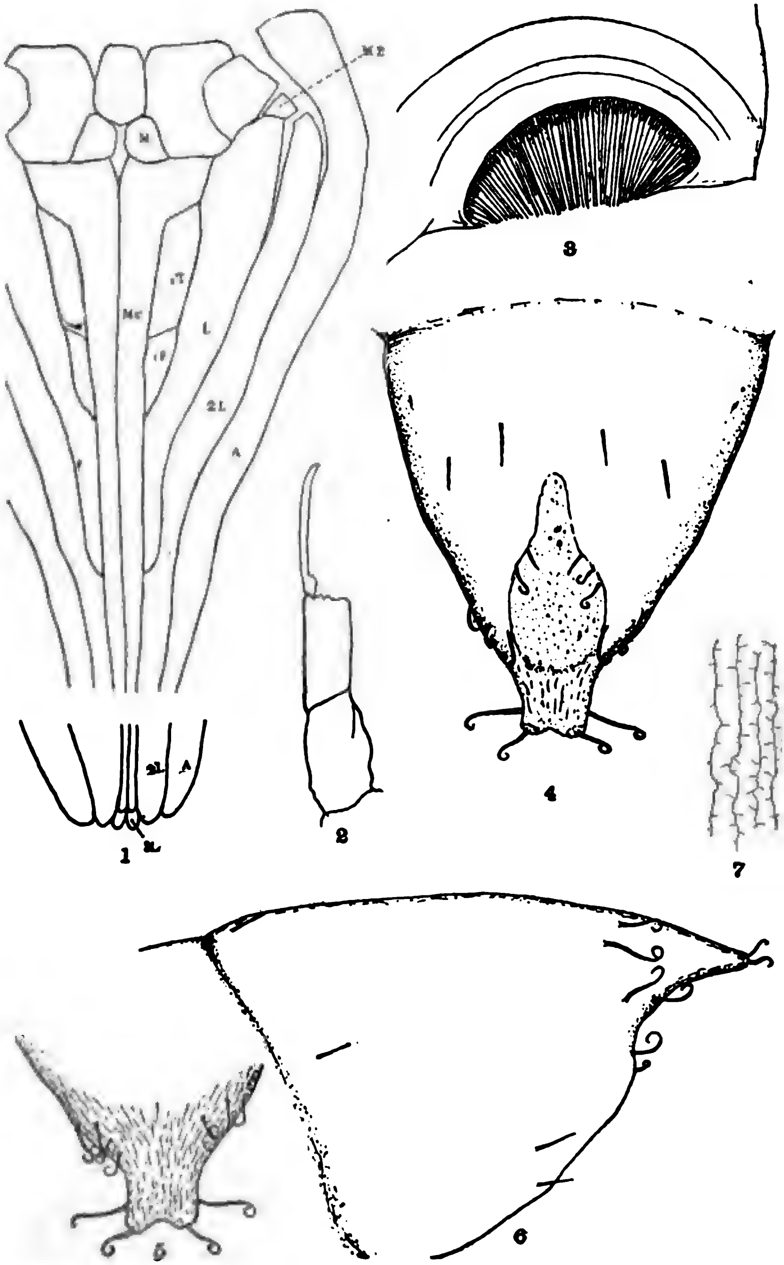
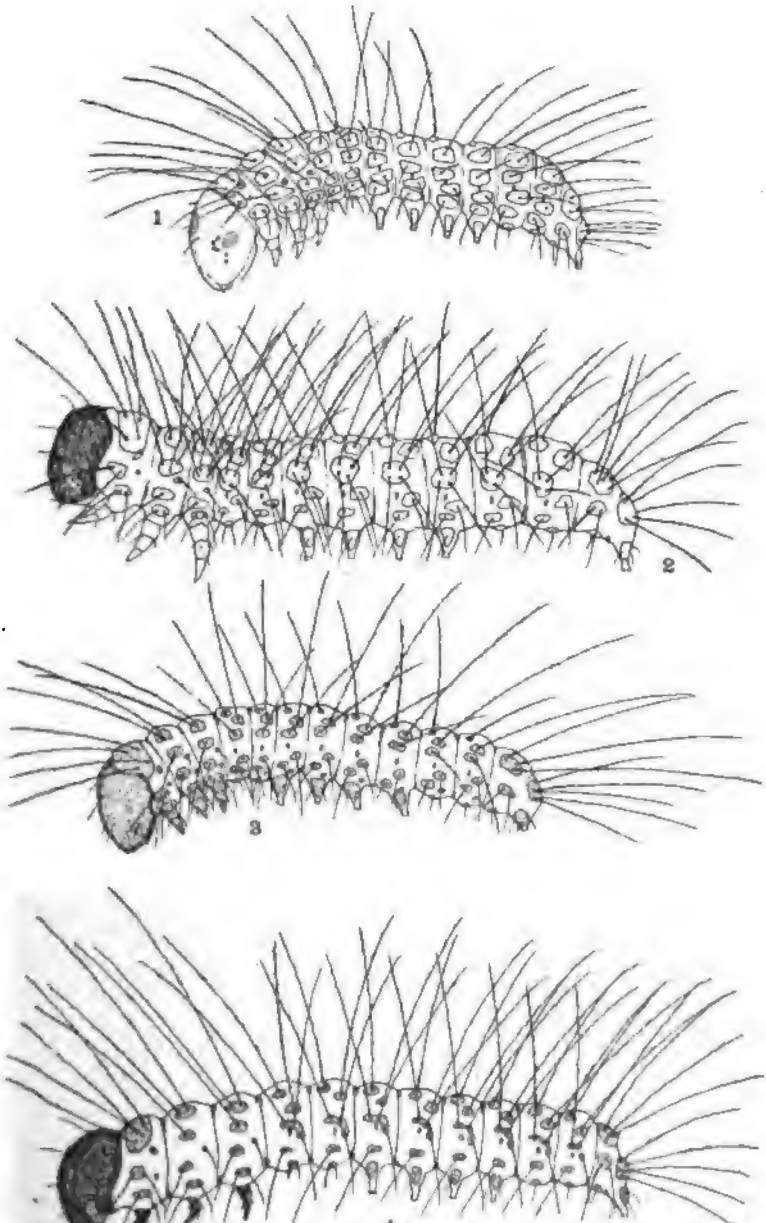


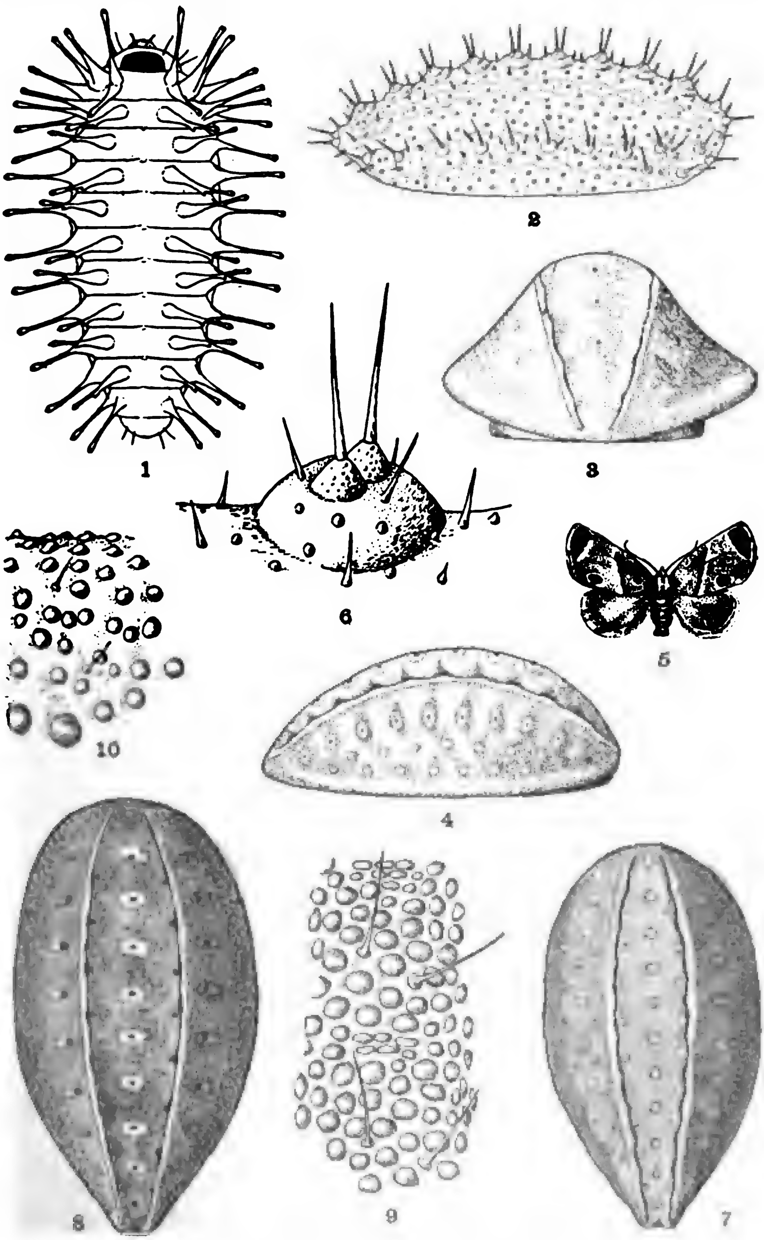
Early Stages of Calybia Slossoniæ.



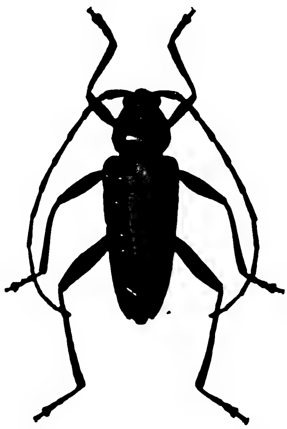
Pupa of Oeta floridana.



Young Larvæ of Arctiidæ.



Life-History of Apoda biguttata.



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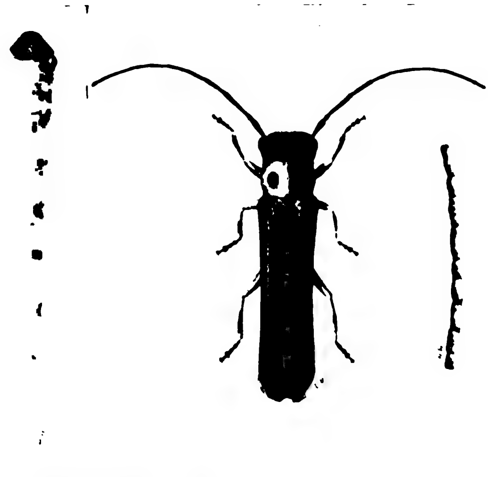

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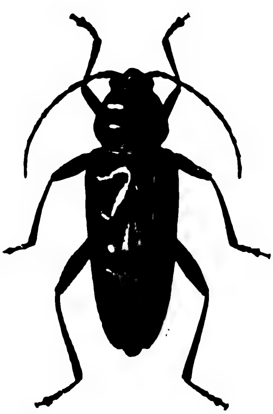

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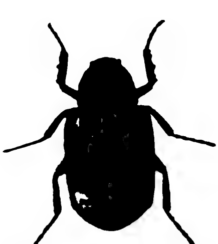

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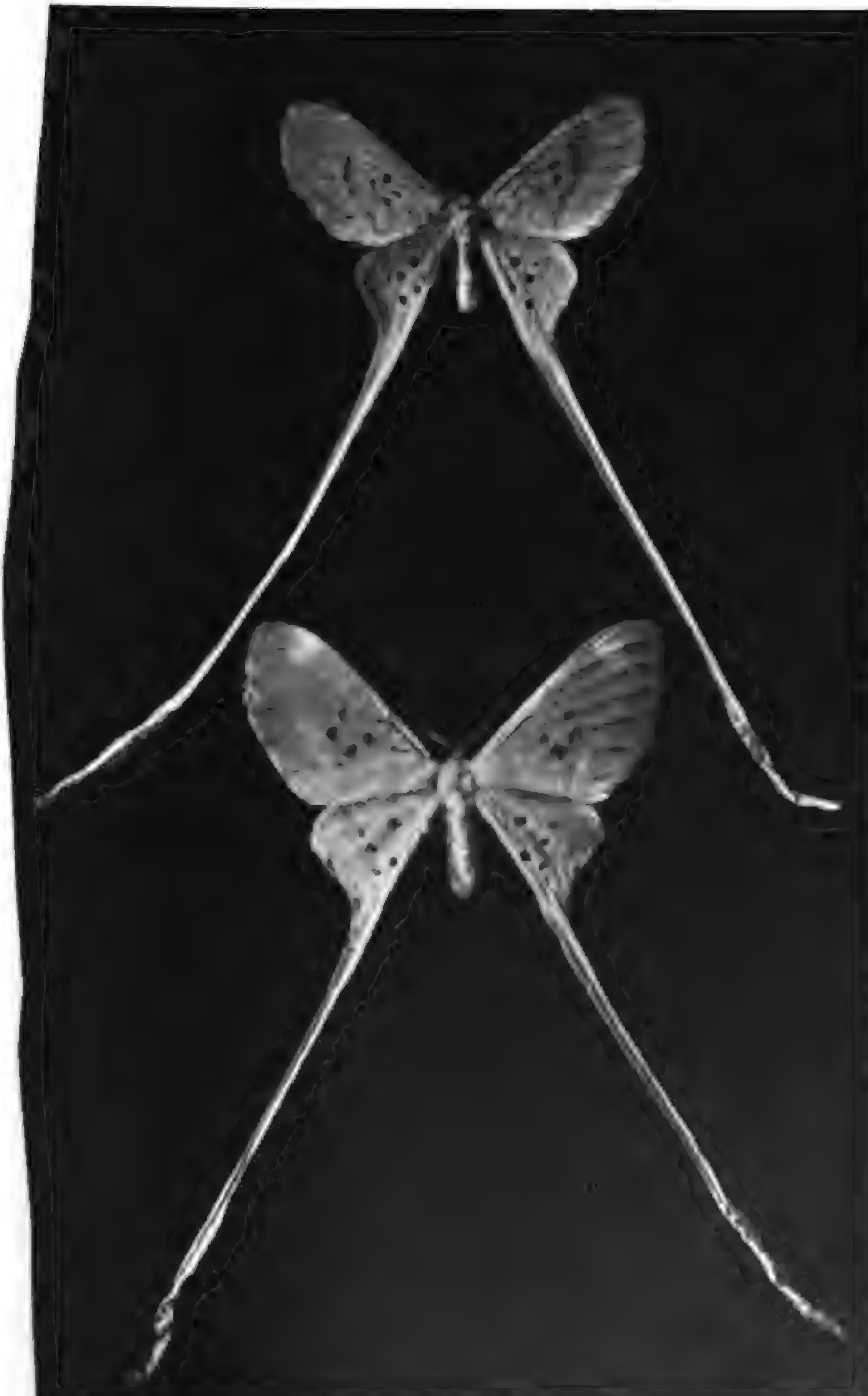
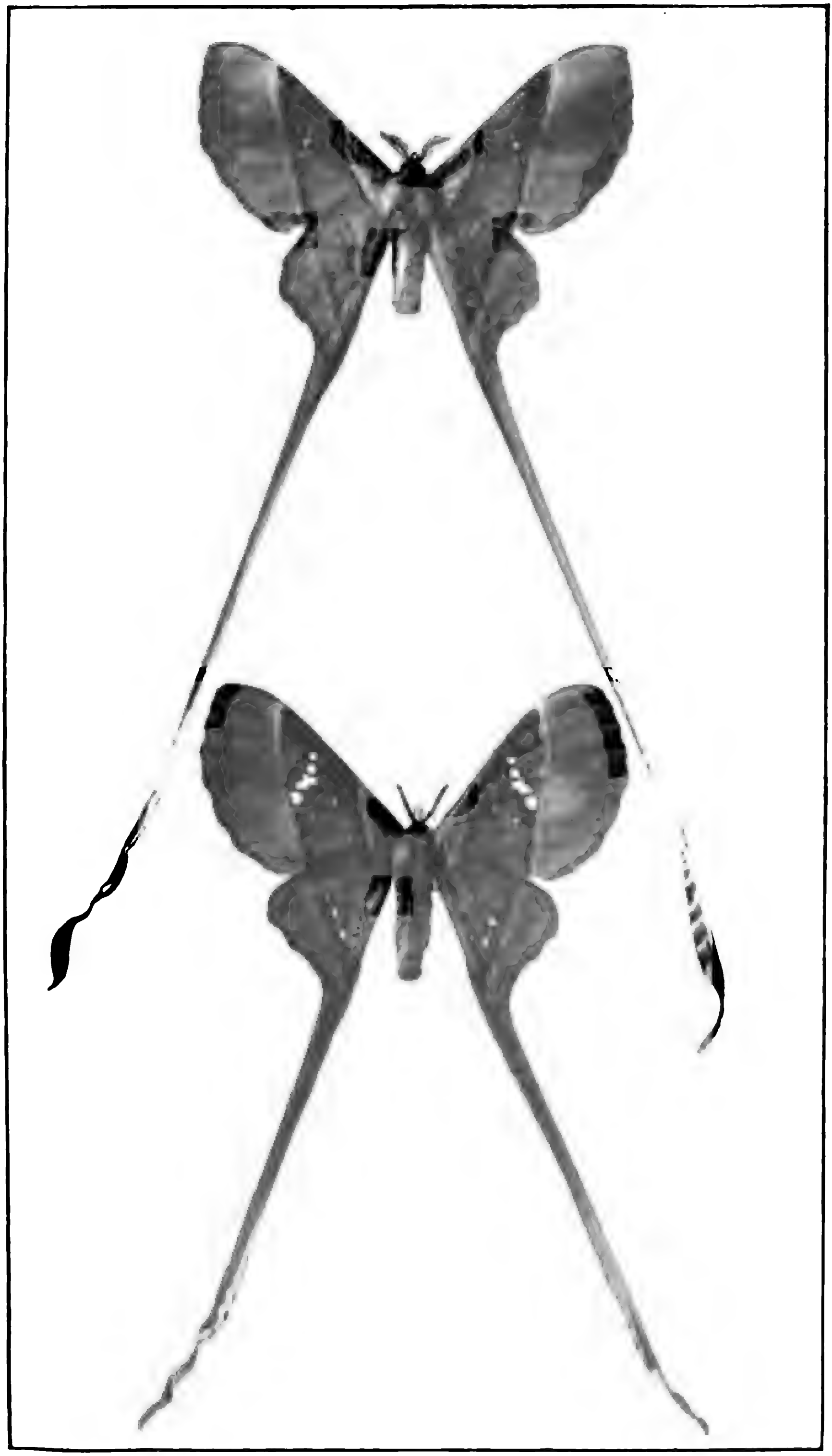
Habits of Coleoptera.



Eudæmonia brachyura.



Eudæmonia argiphontes.

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Vol. VI. MARCH, 1898. No. 1.

THE LIFE-HISTORIES OF THE NEW YORK SLUG CATERPILLARS.—XIII-XIV.

PLATE I, FIGS. 1–12.

BY HARRISON G. DYAR, A.M., PH.D.

Packardia geminata *Packard.*

1864—*Cyrtosia geminata* PACKARD, Proc. Ent. Soc. Phil. III, 343.

1864—*Cyrtosia albipunctata* PACKARD, Proc. Ent. Soc. Phil. III, 344.

1865—*Cyrtosia ocellata* GROTE, Proc. Ent. Soc. Phil. IV, 322.

1866—*Packardia geminata* GROTE & ROBINSON, Ann. Lyc. N. H. N. Y. VIII, 373.

1880—*Packardia goodellii* GROTE, Can. Ent. XII, 242.

1894—*Packardia geminata, albipunctata* NEUMOEGEN & DYAR, Journ. N. Y. Ent. Soc. II, 109.

LARVA.

1891—DYAR, Trans. Am. Ent. Soc. XVIII, 157.

1891—DYAR, Can. Ent. XXIII, 277.

1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 107. (as "Larva of *Heterogenea* (*Tortricidia ?*)")

1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 222.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space moderately broad, flat, narrowing to both extremities, arched; lateral space broad, oblique, narrowing to the ends; subventral space two-thirds as wide as the lateral one, distinct, only slightly retreating, suddenly narrowed in front, tapering behind. Ridges tubercular and setiferous till the last molt, then smooth; subdorsal ridge obsolete, indicated by the rounded angular change in direction between back and sides; lateral ridge slight, dividing the lateral and subventral spaces, subtubercular even in the last stage. Setæ at last rudimentary; in stage I with the structure and arrangement of *Apoda y-inversa* except that the subdorsal spines have the short branch very

rudimentary and the third spine of joint 2 is lacking. Body elongated, sides subparallel, rounded toward the anterior end, joint 13 produced into a slender pointed tail. Skin covered with large, irregular, conic not contiguous, clear granules. Depressed spaces (1) to (8) present, small, ill defined, but devoid of the coarse granules. Color very whitish green, opaque; a white line along the subdorsal ridge with upper dark green, clear border. The centers of the depressed spaces are also whitish, but obscured in the general white shading; (1) and (4) have green centers, but not contrasting. A fainter white line along lateral ridge and subventral edge. The larva is whiter than the backs of the leaves on which it rests, a condition necessary to offset the dark shade which its thickness produces when looked at from beneath. The larva stands about on the same level as *A. y-inversa* in degree of specialization, exceeding it in the presence of the tail-like modification and slightly more reduced setæ of stage I, but falling behind in coloration.

AFFINITIES, HABITS, ETC.

This species belongs to the group of which *Apoda biguttata* is typical, the palaearctic smooth Eucleids. It departs a little from this type as noted above, but not in important characters. Its nearest ally is the other species of the genus, *P. elegans*. The moths emerge unusually early in the season, at the same time as *Tortricidia testacea*, at or before the middle of June. The females rest quietly and do not fly at all till after pairing, even though several nights intervene.* Normally emergence from the pupa takes place during the day, the moths pair the subsequent night and the eggs are deposited in the next night. Flight of the males begins rather late at night, not till after 9:30 P. M. The eggs are deposited singly on the under side of the leaves. The larvæ frequent dry woods and bushes on the edges of fields. They do not inhabit damp or dark locations. Very often the larvæ are found on low small plants only a few inches from the ground, and they are never high feeders. Larvæ occurred not uncommonly at Bellport, Long Island, in a dry pine and oak woods on small wild cherry bushes which had about six leaves apiece and did not exceed a foot in height.

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* Most ♀ Eucleids fly on the second night after emergence, and if not mated the previous night, refuse the ♂ entirely. *Phobetron* and *Calybia* are an exception, for they will mate after an infertile flight, but in this case the eggs are without vitality, most only proceeding to the first embryonic stages, and those that do hatch never live to mature.

This species has a northern range. I obtained it at Jefferson Highlands, N. H., in the White Mountains, where only a few species of Eucleidæ are found. Its southern limit is not known, though it occurs throughout New York. It is one of our rarer species, yet locally fairly common.

There are six or seven stages. The former number is here described. When seven stages occur, the extra one is interpolated after stage *V*. It resembles stage *V* closely, the white depressed spaces being a little more distinct, setæ large. The larva under observation fell behind in length from the measurements given more and more in each stage, but attained the same final size, owing to the extra stage. The young larva possesses distinct urticating power, in spite of the absence of stinging spines. The sharp setæ, though not converted into true spines, probably function similarly.

CRITICISM OF PREVIOUS DESCRIPTIONS.

I have given the characters of the mature larva several times. I suppose Dr. Packard's brief description of an unidentified form to have been taken from this species, although the description is scarcely determinate. It could hardly be anything else, however.

In the present descriptions I have gone a little beyond my brief in including in the synomymy the dark forms *albipunctata*, *goodellii* and *ocellata*. Nothing but the pale form *geminata* was bred from these larvæ, so that there is a possibility of another species.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Rather narrowly elliptical, flat as usual, translucent white on glass, shining like a wet spot on the back of the leaf; 1.3×.7×.1 mm. Reticulations rather distict all over the egg, but much rounded, like circular shallow pits, varying a little in size. They hatch in 14 days.

Stage I.—Rounded, thick, tail rounded; spaces all of moderate width, the subventral one small. Color translucent whitish. Spines transparent, short, clubbed-tipped, the subdorsal ones on joints 5, 7 and 9, leaning out slightly and the lateral one of joint 5 leaning up. Joint 2 not much retracted, a large cervical shield with several fine setæ. The subdorsal spines on joints 4–12 have just a trace of the side branch, seen in certain lights as a small irregularity. Skin smooth; slight segmental hollows are present dorsally at the upper sides of the bases of the tubercles. Arrangement of the setæ (Plate I, fig. 2), as in *Apoda y-inversa* except that there is only one middle seta on joint 4. The outer third

of the seta is everted from the middle portion on hatching, sometimes remaining incompletely so. No spines present on first emerging from the egg. Length, .9–1.7 mm.

Stage II.—(Plate I, fig. 2.)—Rather elongated elliptical, tail rounded quadrate, joint 3 truncate in front. Setæ normal, two on the subdorsal ridge, one on the lateral, distinct, long, sharp pointed. The middle row on the thorax is represented by two setæ on joint 3, and by one only or a large and a small one on joint 4. Ridges distinct, the dorsum and sides concave. Head retracted; joint 2 partly so. Skin rather densely frosted with clear conic granules, not contiguous, nowhere produced into secondary spines. Depressed spaces hardly indicated (1) as slight hollows, not differentiated by the granules and very small. Color pale whitish green, evenly tinted. Length, 1.6–2.5 mm.

Stage III.—Narrowly elliptical, tail small, square. Dorsal and lateral spaces broad, subventral smaller. Ridges marked, high, segmentarily tubercular, the setæ stiff, black, distinct. Color plate translucent whitish green, a faint white line under the subdorsal ridge, not reaching either extremity. Skin with remote, low, rounded granules (Plate I, fig. 4), no spines anywhere. Depressed spaces small, shallow, not sharp edged, smooth in the bottom. Length, 2.3–3.5 mm.

Stage. IV.—Elliptical, tail produced a little and tapering, notched. Whitish green, a distinct white band below the skin of subdorsal ridge on joints 4–13. Lateral ridge prominent, even with the subventral edge or a little beyond it. Dorsal impressed whitish dots (1) distinct on the central segments, interrupting the faint green line of the dorsal vessel. Skin smooth except for the remote, irregular, clear granules, the surface slightly sunken to represent the depressed spaces. Length, 3.5–5.2 mm.

Stage. V.—Somewhat more like mature larva; tail truncate. Skin more densely clear granular, the granules nearly contiguous. Subdorsal ridge with a distinct yellowish white line on joints 3–13; a row of dorsal dots (1), only five of them distinct (joints 5–9). Ridges gently undulating from the outline of rudimentary tubercles. Setæ short, distinct. Depressed spaces indicated, but like the rest of the skin, granular. Color, translucent green, dark, not yellowish. Head green, eyes black. Length, 5.2–7 mm.

Stage VI.—(Plate I, fig. 6.) Shape as described. Skin granules transparent, contiguous, covering the whole surface. Depressed spaces very small, the dorsal (1) smooth, whitish with green centers; addorsal ones (2) absent on the surface, but represented by white dots below the

skin. Lateral large areas (4) and (6), indicated by pigment under the granules, the smaller ones not represented. Tubercles obsolete, setæ minute. The body is elongate, rather narrow, highest through joints 7-8. Color, whitish green, becoming whiter during the stage as the pigment is slowly deposited. A dorsal green line interrupted by the dorsal impressed spots, subdorsal lines straight, yellowish white, connected on joint 3 and on the tail, edged above with dark green. A row of white dashes on the lateral ridge, the large depressed spaces (4) becoming whitish with dark centers like (1). Length, 7–11.5 mm.

Cocoon and pupa as usual.

Food-plants.—Wild cherry, white birch, black birch, oak, bayberry, sour gum, hickory and *Clethra alnifolia* have been observed.

Packardia elegans *Packard.*

1864—*Cyrtosia elegans* PACKARD, Proc. Ent. Soc. Phil. III, 342.
1864—*Cyrtosia fusca* PACKARD, Proc. Ent. Soc. Phil. III, 343.
1881—*Packardia nigripunctata* GOODELL, Can. Ent. XIII, 30.
1891—*Packardia elegans* DYAR, Trans. Am. Ent. Soc. XVIII, 157.
1894—*Packardia elegans* NEUMOEGEN & DYAR, Journ. N. Y. Ent. Soc. II, 76.

LARVA.

1864—PACKARD, Proc. Ent. Soc. Phil. III, 343 (cocoon; no larva).
1881—GOODELL, Can. Ent. XIII, 31 (brief desc.).
1890—PACKARD, 5, Rept. U. S. Ent. Comm. 149 (quotes Goodell).
1891—DYAR, Can. Ent. XXIII, 277.
1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 100.
1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 222.

SPECIAL STRUCTURAL CHARACTERS.

Elongate elliptical, rounded before, joint 13 produced into a pointed tail. Dorsal space rather narrow, diminishing a little at the ends, slightly arched, highest at joints 6–7; lateral space broad, concave; subventral space broad, narrowly retracted in the middle. Ridges moderate, the lateral the most distinct, subtubercular, setiferous; smooth in the last stage. Skin rather coarsely clear granular, always without secondary spines. Depressed spaces feebly developed, (1) and (4) show faintly as pale rings, seen by transparency as if at the bottom of pits with convergent sides. Pigment unusually scanty; a band of green color extends along the upper half of lateral area below the subdorsal ridge, elsewhere the body is transparent, faintly colored greenish by the blood. Dorsal vessel plainly seen and the contents of alimentary canal, showing through the dorsal space. At the end of the last stage the

pigment fills in somewhat better. Tail conic, setæ of joint 13 widely separated on it. First stage as in *P. geminata*.

AFFINITIES, HABITS, ETC.

Closely allied to *Packardia geminata*, differing only slightly. The granulation is more dense, appearing earlier in ontogeny, but the pigmentation is much degenerated. The moths do not emerge as early in the season as *P. geminata*, yet fairly early, June 25th to July 2d, in my examples. The females are less quiescent than the allied species and fly violently if not mated the first night after emergence. After this night they will not mate at all, even though males be present, but continue to lay infertile eggs, or else refuse to lay and die in a few days. The eggs are deposited singly on the under sides of the leaves where the larvæ live.* The larvæ frequent dark woods. The deep shade seems to be the essential factor as they will occur in any woods whether wet or dry if dark enough. I have found them on the thin pale leaves in the dry woods on Goat Island at Niagara Falls and also in an almost swampy grove in Van Cortlandt Park, New York City. I have found them on Long Island, not commonly, as dark woods are rare on the Island. The larvæ are low feeders, but not so low as *P. geminata*. As in the case of its ally, the larvæ can be found in fair numbers by looking in the right places. Except by breeding the moth is seldom taken.

CRITICISM OF PREVIOUS DESCRIPTIONS.

Mr. Goodell mentions the larva without detailed description. Subsequently it has been described adequately by Dr. Packard and myself. Dr. Packard describes a series of dorsal dark green spots which he says "does not form a tubercle or flattened wart." This is, indeed, very true, because the spot is the center of the dorsal depressed space. I suppose the only reason for making this statement to be the same false idea of the homology of these structures to which I have referred under *Tortricidia fasciola*.

* Professor Poulton remarks (Trans. Ent. Soc. London, 1888, p. 591), "it is well known that these larvæ (Eucleidæ) rest on the upper surface of the leaves of their food plants." I cannot imagine on what this statement is based. Of the nineteen species of North American larvæ now well known to me, only one (*Phobetron pithecium*) ever rests on the upper side of the leaf, and this in the last stage only when its peculiar shape and color make it resemble a piece of dead leaf that had fallen from above. I cannot well believe that the two European species have different habits from our smooth Palæarctic Eucleids.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Elliptical, flat, 1.0 × .6 × .1 mm.; whitish transparent, colorless. Reticulations distinct, irregularly quadrangular, narrow, raised. In the bright light with the green leaf behind they appear as narrow black lines, bordered by a bright area on both sides, the flat cell-areas dusky grayish. They hatch in 10 or 11 days.

Stage I.—Just like *P. geminata*, the spines arranged the same (Plate I, fig. 1); all short with irregularly knobbed tips. Branches of the sub-dorsal spines just distinguishable as little protuberances. Elliptical, rounded, dorsum and sides grooved, subventral space small. Ridges smooth, setæ colorless. Skin shining, smooth, colorless, transparent; food green; head concolorous. Length, .8–1.4 mm.

Stage II.—Obscure, not shining, pale whitish, just tinted with green, translucent. Elongate elliptical, narrow, the tail narrowly quadrate. Ridges slight, non-tubercular, two setæ on subdorsal ridge, one on lateral ridge, normal, except only one on the middle row of joint 4; black tipped and with stout expanded bases. Skin granules small, sparse, low conic, clear, alike everywhere, not produced on the ridges. The largest depressed spaces, (1) and (4), are indicated as slight hollows. Length, 1.3–2.1 mm.

Stage III.—Elongate elliptical, narrowing posteriorly, tail rounded, not produced. All frosted whitish, scarcely tinted with green. Setæ distinct, sharp, black tipped, arising from slight tubercles on the subdorsal ridge, distinct conic segmentary ones on the lateral ridge. All of skin surface and tubercles covered densely with small low conic clear granules, uniformly even over the obsolete depressed spaces, where they are scarcely thinner. The granules are very numerous, almost contiguous, but rounded, not appressed. (Plate I, fig. 5.) The shape is now unusually narrow, dorsal space not narrowing much to the ends. Very colorless, translucent, the blood only slightly green and no pigment present. Length, 1.8–3.0 mm.

Stage IV.—Narrow, elongate, truncate before; tail produced, but tubercular like the ridges. Frosted whitish from the granules and, therefore, slightly opaque; almost entirely without pigment, the blood visible pulsating, slightly green tinted. An obscure whitish dot under the subdorsal ridge at each intersegmental space, representing a subdorsal line. Setæ short, black and distinct. Granules small, even, dense, but not quite contiguous, running uniformly over the whole surface; depressed spaces scarcely indicated anywhere. Length, 2.8–4.0 mm.

Stage V.—Elongate, anterior end rounded, posterior pointed but without a well formed tail. Dorsal space moderate, even, but little arched, lateral broad, subventral moderate. Ridges low tubercular, with distinct dark setæ. Skin clear granular, whitish; all very transparent, green pigment only in the upper half of lateral space, none in dorsal space which appears darker from the food showing by transparency. A waved subdorsal line, bent inward on the interspaces, free at the ends. Depressed spaces not visible, except faint white rings to represent the lateral ones (4). Length, 3.8–5.8 mm.

Stage VI.—Narrowly elliptical with a pointed tail; setæ short, black, distinct. Pigment in the upper half of lateral space, the rest of the body clear green from the blood, translucent and whitish in the edges. A wavy yellow subdorsal line, free at the ends. Dorsal depressed spaces (1) very faintly indicated by whitish dots, visible centrally only; lateral (4) as large intersegmental white rings, but probably at least the glands of all the spaces (1)–(8) are present, as drops of moisture were observed in the appropriate position of them all in the larva under observation. Skin granules rather coarse, dense, but not contiguous, the depressed spaces not differentiated. Length, 5.0–8.5 mm.

Stage VII.—(Plate I, fig. 9, 10). Shape as described. Patches of pigment in the dorsal space surround the rings of depressed spaces (1). Light yellowish green, lateral edge clearer, dorsal space darker. A waved, narrow, yellow, subdorsal line, free at the ends; tail reddish brown above. The absence of pigment in the dorsal space makes it look hollow, though it is really flat. Six of the depressed spaces (1) are visible as white rings, around which more or less light emerald green pigment forms in rings, transverse bands or even filling all of the dorsal space (Plate I, fig. 10.). The subdorsal line is composed of a series of intersegmental, inwardly lunate, joined yellow marks. Lateral space to lower edge of depressed spaces (4) pigmented light green, (4) large pale rings with dark centers. A trace of pale dots along lateral ridge intersegmentally. Tail long, pointed; setæ very small, pale. Skin granules rather large, somewhat irregular, not quite contiguous, at the largest depressed spaces, (1) and (4), less distinctly granular over the slight hollows. A broken white subventral line. Length, 7.1–13 mm.

Cocoon and pupa as usual.

Food-plants.—Linden, witch-hazel, hop-hornbeam, beech, maple, black birch, wild cherry, sour-gum, black oak, chestnut, hickory and *Leucothoë racemosa*, have been observed.

EXPLANATION OF PLATE I.

Fig. 1. Stage I of *Packardia*, dorsal view, enlarged.
" 2. Stage II, side view enlarged.
" 3. The subdorsal setæ of one tubercle, stage II, more enlarged.
" 4. Granules of *Packardia geminata*, stage III, enlarged.
" 5. Granules of *Packardia elegans*, stage III, enlarged.
" 6. Mature larva *P. geminata*, three-quarters view.
" 7. Moth of *P. geminata*.
" 8. The same, dark form. var. *albipunctata*.
" 9. Mature larva of *P. elegans*, three-quarters view, partially pigmented.
" 10. The same, dorsal view, fully pigmented form.
" 11. Moth of *P. elegans*.
" 12. The same, pale form, var. *fusca*.

AN ATTEMPT TO CLASSIFY THE HOLARCTIC LEPIDOPTERA FROM THE SPECIALIZATION OF THE WINGS.

PART II.—THE HAWK AND EMPEROR MOTHS.

BY A. RADCLIFFE GROTE, A.M.

C. Radius 5-branched; vein IV2 central or cubital; hindwings with intercostal crossvein.......... **SPHINGIDES.**

c1. No costal vein (vein I) on primaries; vein III2 absorbed by Radius; crossvein degenerate; vein IV2 decidedly cubital......ENDROMIDIDÆ.

c1. A costal vein (vein I) on primaries; vein III2 from Radius before extremity of cell; crossvein entire; vein IV2 not decidedly cubital SPHINGIDÆ.

D. Radius 3–4 branched; vein IV2 central or radial; hindwings with no intercostal crossvein.......... **SATURNIADES.**

d1. Vein IV2 continuous with vein IV1..........SATURNIADÆ.

d2. Cell open..........ATTACINÆ.

d2. Cell closed.

d3. Hindwings without vein VIII..........SATURNIANÆ.

d3. Hindwings with vein VIII..........HEMILEUCINÆ.

d1. Vein IV2 from crossvein..........AGLIADÆ.

d4. Hindwings without vein VIII.

d5. Crossvein, between IV2 and IV1, directed obliquely outwardly AGLIANÆ.

d5. Crossvein transverse..........AUTOMERINÆ.

d4. Hindwings with vein VIII..........CITHERONIADÆ. *

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* This table (*C*, *D*), and that of the Day-Butterflies (*A*, *B*), is compiled in accordance with the sequence in the Lepidoptera which I recommend, and not altering the Linnean arrangement upon opinionative grounds.

ENDROMIDIDÆ.

The subprimary tubercles of the larva (3 and 5) in stage I are wanting on the thoracic segments (I to III). On the abdominal segments the subprimary tubercle 6 is also wanting. In the "Saturniiden," page 6, I figure abdominal segment, but the bristles marked "6" are too low down for this and evidently belong to 7. I indicate this doubt in the text (p. 5). On the same segments the tubercles 5 and 4 are separate. There appears to me no insuperable objection to the view, that *Endromis* represents an isolated form of the Hawk Moth stem, separating soon after this stem had emerged from the Tineid trunk. The retention of the intercostal vein is then an independent survival of a character shared by both when the Endromid branch made its separate way. Dyar has enabled us to show that the type of the Endromid larva is opposed to the Saturnian and the latter to the Sphingoid type. The neuration excuses me in considering *Endromis* as an aberrant Sphingoid type. It is not improbable that the larva of an existing generalized Sphinx might throw some light on the matter through a comparison of parallel stages. When we turn from the larva to the pupa, we find that the segments of the abdomen are capable of movement in *Endromis* and by their aid the pupa is forced out of the cocoon before exclusion, as in *Anthrocera*, *Cossus* and the Tineides generally. Preparations before me of *Endromis* and *Anthrocera*, hatched in my breeding cages, show a striking similarity in this habit. The Sphingidæ seem to have the habit also, inasmuch as the naked pupa is stated to wriggle its way to the surface of the ground to allow the escape of the moth. Such species as transform on the surface within a slight cocoon have not, to my knowledge, been observed as to this point. This habit indicates a direct connection of the Sphingides with the Tineides. The links between *Endromis* and *Sphinx* appear to have dropped out; also those by which we might more surely trace the relationship between adult forms of the Sphingides and Tineides. Nevertheless, I call attention to the fact that the Anthroceridæ represent a Tineid branch possibly related to the stem which threw off the existing Sphingides.

Leaving these characters, we will consider the neuration. And first the shape of the wings is modified, and this probably in accordance with the method of flight. Disposed as I am to consider the Sphingides and Saturniades as parallel groups, each specialized in a different way, and the Saturniades unquestionably the more highly so, I would compare the Endromididæ with the Saturniadæ and the Sphingidæ with the

Agliadæ (the Citheroniadæ especially). For the moment we will consider and compare the Endromid and Sphingoid wing. The vein on costal edge of primaries (vein I) present in the Hawk Moths is absent in *Endromis*. This vein (or thickening, according to some of the costal edge) is found in the Hesperianæ but not, so far as I know, in the Pamphilinæ. The most striking difference between *Endromis* and *Sphinx*, is found in the evident effort in the former to get rid of vein III2. This springs from the Radius, near III1, in the Hawk Moths. In *Endromis* it is absorbed and appears as a short branch before apex.* This is a secondary character, belonging to the general direction of a diminution in the normal number of the radial veins. This direction has apparently been followed out and brought to a higher stage throughout the Saturniades. But the inequality of its expression is here no indication of the phylogeny, seeing that it is everywhere exhibited in different perfection and upon different lines of descent. It is my *second direction* in the general evolution of the lepidopterous wing.

In my *first direction*,† the suppression of the Media, *Endromis* has progressed further than *Sphinx*. For the cubital direction of vein IV2, often only indicated in the Hawk Moths, here becomes assured and evident. The crossvein already shows signs of degeneration. The wing, in broadening, has lost the strength requisite to sustain swift and prolonged flight. There is, in *Endromis*, a less crowding of the veins; they do not appear so like rigid and parallel rods. There is a larger space between the Cubitus and vein VII, so that VI there appears as a fold in the membrane. Both families retain VIII as a loop to VII on primaries, and there is no trace of other internal veins. On secondaries vein VIII is equally preserved. Looking at the two wings I am met with no character which renders it unlikely that they may have had a common origin. Here is where positive character may be said to end and where the tact and experience of the observer comes into play. But, on the threshold of this disputable region, I can yet point to the intercostal vein and throw the onus of proof on those who dispute the classification. As between *Endromis* and *Sphinx* there is no question which has submitted to most specialization in the neuration. In both

* In *Amphidasys betularia* the absorption of III2 by III1 is clearly seen to be in process of being carried out.

† Perhaps we should call this rather the "second direction," seeing that the suppression of the radial veins is used as a primary divisional character of the Suborder, but in the lepidoptera, as we find them now, the breaking up of the median system excites everywhere the chief interest.

main directions *Endromis* shows the most progress. Still, we shall have to discuss the relation between these specializations and habit, although here the matter may detain us no further.

It may be here remarked that it is not strictly correct to speak of the Cubitus "becoming three or four branched." The Cubitus is always two-branched. It is the movement of the lower branches of the Media, which become varyingly attached to the Cubitus, thereby giving the appearance of increasing the number of the cubital veins. In the opposite direction, it is the same way with the Radius.

SPHINGIDÆ.

The absence of homology between the anal horn of the Hawk Moths and the similarly situated hypertrophied tubercle of the Emperor Moths has been determined by Dyar and is illustrated by me in the "Saturniiden," pp. 7–8. The two groups have then no immediate connection and the correspondence with the Citheronians is illusory, the common habit of pupation of secondary acquirement. The venation, both of *Endromis* and *Sphinx*, entirely warrants this view of the case. We need not detain ourselves with these matters here but pass on to the venation. The mass of preparations I have made show me that this offers no characters of precision for a division into subfamilies. The wings appear cast, like iron, into the same mould. Still there is a play with the branches of the Media and it is often not difficult to decide, as between distinct forms, which is the more specialized. Harder to embrace these forms into groups. A form like *Cephonodes picus* seems specialized from the amount of absorption of vein IV1 by the Radius on primaries, the retreating, almost vanished cell on secondaries, the fusion of IV3 with V1. *Cephonodes* is more specialized than *Hemaris*. As between *Macroglossum* and *Aellopos* it is hard to distinguish; they seem practically identical. The obliquely transverse and rigid crossvein of primaries is the same and all goes to show that the position assigned by me to *Aëllopos* in 1865, among the Macroglossians, is correct and that its placement among the Chærocampians in the Philadelphia List is erroneous. A study of the neuration seems to favor the idea that the Macroglossians are really the more highly specialized of all the groups. On the other hand, that portion of the hind wing between Cubitus and the anal margin appears generally more lappet-like in the Macroglossians (shared by *Aëllopos*) as compared with the Elephant Hawk Moths. There is a decided indentation of the outer margin between V2 and VII. Almost does this character seem a probable test to distinguish the groups.

Still, it reappears more or less evidently and constantly not only in the Chærocampians but in the Eyed Hawk Moths; an indentation appears in *Sphinx ligustri* and *Hyloicus pinastri* and is replaced by a broad excision between V1 and VII in *Dilina tiliæ*. It appears less evidently in *elpenor* and *lineata*. There seems then mainly the movement in the branches of the Media, which simply affords a criterion for the relative specialization. Judged by this, *Acherontia atropos* is more specialized than the majority of the Smerinthoid types, although it is overlapped by *tiliæ* and nearly reached by *Smerinthus populi*.* The shape of the secondaries in the Eyed Hawk Moths varies much. This differs even in *Calasymbolus astylus* and *Eusmerinthus geminatus*, while *Copismerinthus ocellata* and the allied North American species are distinguished by the tibial claw.

On the whole, then, the neuration of the Sphingidæ offers apparently no opposition to the general sequence of Kirby, which is that adopted by me in the Buffalo Catalogues, except that I gave the Eyed Hawk Moths a central position. But, for probably the true reason, viz., that I regarded the Smerinthinæ as nearer a more original Sphingoid type, from which the present groups have emerged in different directions. I was much struck by the resemblance of *Ambulyx* with Smerinthoid genera, and fancied that the Chærocampians might have had a separate and nearer connection with the stem which the Eyed Hawks represent. Hence I gave these a central position. The discovery of *Ambulyx sexoculata* Grote, strengthened this view of the case. But the arrangement of the genera adopted by Kirby is open to betterment in the light thrown by the details of the neuration. This is, however, a matter for the future student and need not to be here discussed.

From an examination of Siberian and European examples I would here simply correct Kirby's list of the species of *Smerinthus* and *Eusmerinthus* (Cat. pp. 711, 712). *Copismerinthus* is not a synomym of *Eusmerinthus* Kirby, as wrongly cited (p. 712) but of *Smerinthus* Kirby. This author has not understood the character and mixed the species. *Eusmerinthus* wants, *Copismerinthus* has, a tibial claw.

* From a note made by me when examining Latreille's works, *populi* is indicated as the type of *Smerinthus*, by being once solely cited. I regret that my note is not definite and that I have been unable, despite several efforts, to again consult all of Latreille's publications. Kirby prefers *Dilina* of Dalman, 1816, for *tiliæ*, and this is probably correct.

Eusmerinthus Grt., 1877. Type: *E. geminatus.*	*Copismerinthus* Grt., 1886. Type: *C. cerisii.*
1. *kindermanni* Led.	1. *ocellata* Linn.
2. *cæcus* Mén.	v. *atlanticus* Aust.
3. *planus* Walk.	2. *cerisii* Kirb.
argus Mén.	*opthalmicus* Boisd.
4. *geminatus* Say.	*vancouverensis* Butl.
? *jamaicensis* Dru.	3. ? *saliceti* Boisd.

The classificator must rely in great part on the body characters, the pattern of ornamentation, and, so far as I see, will run no great risk of being contradicted by the neurational features overturning his groupings. Nevertheless, when taking the question of specialization in hand, the neuration will afford him valuable hints which he will do well to respect. As to the name for the above genus (*Copismerinthus*) Kirby has adopted my former and original opinion that *ocellata* was the type of *Smerinthus*, an opinion I retained in my "Hawk Moths of North America." But, from my notes of Latreille, I believe *populi* may be really the true type of his genus. Whichever way the matter is settled, by reference to the original works, I have at least here sorted out the species accordingly as the front tibiæ are or are not armed. The North American genera *Paonias* (for *excæcatus*), *Calasymbolus* (*astylus*) seem to me on other grounds distinct from each other and from the above. (Consult an article on the frenulum of the British species of *Smerinthus*, by Geo. C. Griffiths, Ent. Record. VI, 250.)

SATURNIADES.

In the "Saturniiden," p. 6, I figured the first larval stage of the Silkworm, *Bombyx mori*, showing, from the arrangement of the tubercles, that this larva was related to the large group circumscribed by Dyar and which I had called Agrotides. The Silkworm has therefore to be excluded from the Emperor Moths. The Saturniades, cleared of this foreign element, have been taxonomically defined by Dyar by the presence in the larva of a system of subprimary tubercles, wanting in the Sphingides, as here accepted.* The pupa gives the moth within the cocoon. The Citheronian habit is not recorded. A nearer relationship, such as we can show for the Sphingides, with the Tineides is not yet indicated. There exists a temptation to regard the Ptochopsychidæ

* Mr. Grote has misunderstood me. I separate the Saturniides and Sphingides on the position of tubercle iv; neither group has distinguishable sub-primary tubercles. *Endromis* is a Bombycid except for the absence of sub-primary tubercles in stage I, which I do not regard as a strong character at present. I shall return to this point elsewhere.—H. G. DYAR.

and Psychidæ as standing in a connection with the ancestral line of the Emperor Moths, which may be merely noticed in passing.

Bearing in mind the two directions in which the evolution of the wing is chiefly displayed, we find in the Attacinæ their fullest development. In fact the wing of *Rothschildia jacobæa* represents almost the ideal apex of the movement. In the *first* direction, the Media and its system, as such, has completely disappeared. The crossvein has vanished. Veins IV2 and IV1 form part of the system of the Radius, vein IV3 forms part of that of the Cubitus. That portion of the crossvein, belonging to it morphologically, lying between IV2 and IV1, has become physiologically the base of vein IV2*. In the *second* direction, the radial branches are reduced to three from five. Added to this, the concave inner margin of the secondaries has lost vein VIII. By this latter character we are reminded of *Papilio*, and that the concave margin is a specialization is made clearer in this case by its more excessive development, attended by a shrinking in the length of vein VII, in the more specialized *Parnassius*.

There will come a time, to speak after the fashion of Mr. Strecker, and the ancient Greeks, when the uncritical classification which thrusts the Papilionides between the Blues and the Skippers (these latter two, as we believe, nearly related) will be read with amazement. The fable that the Papilionid wing is the most generalized must give way to the view that it is peculiarly specialized by the suppression of vein VIII of secondaries. Generalized it is, as compared with *Parnassius*, but it should not be compared with the other butterflies, since it has had a different line of development. Undoubtedly, the irritable defense of Mr. W. H. Edwards that *Papilio* has six walking legs and *Nymphalis* only four, was not sufficient to dispel the illusion clinging to the system of Bates. It was also felt that the more ideal championship of Wallace, that *Papilio* was so large and complete, could not excuse its being placed "at the head" of a phalanx in reality, a phalanx spreading over the plain of the present without a leader. All this was perceived, and other similar attacks upon a system adopted by my friend Dr. Scudder, and thus made part of the supreme cult of Boston, fell equally powerless. So that newcomers, rising from obscurity, felt themselves obliged to confess the creed as a matter of "my opinion," and to follow up the futile expression of *credo quia ineptum* by the statement that "the sequence is in accord with the more conservative modern classification." Where this more conservative modern classification leads to we may see

* Compare Mittheilungen aus d. Roemer-Museum, No. 8, p. 24.

in the case of Mr. Meyrick, who puts the Caradrinidæ "at the head." As matters stand Mr. Meyrick will undoubtedly be applauded to the echo by Mr. Hulst. Because, in the Lepidoptera, "students have specialized (!) and few collectors, even, go outside of the Macro-Lepidoptera." Prof. J. B. Smith has, "therefore (?) secured the co-operation of Dr. Henry Skinner in the Rhopalocera;" and Dr. Skinner warrants the endorsement of the Preface of the Philadelphia List by placing the Milkweed Butterfly "at the head" of the "Nymphalidæ." After this specimen of "modern classification" one may well put the List by with the feeling that whatever may be the cardinal error of the Boston creed, neither in Brooklyn or Philadelphia is there any salvation. The suppression of vein VIII of the secondaries, in the most specialized of the Emperor Moths, is a direct monition of the value of the character in the Papilionides. In this latter super-family the more specialized forms show clearly additional features of advancement, so that the lessons taught by the suppression of vein VIII is no longer needed to enable us to appreciate their development. The reason why this was not considered is, that the gauge for specialization offered by the wing was not understood, so that loose notions as to sequence and rank were not only permitted, but, the more bizarre they were the more they were thought "scientific," until at last we are landed in the anarchy offered us by Mr. Meyrick.

The Attacinæ have served us here for a text upon *Papilio*, and to the Emperor Moths we now return. The fact that the diminution of the radial veins in a secondary development, occurring in pursuance of evolutionary law, up and down throughout the more specialized groups (such as the Parnassinæ, Pierinæ, Lycæninæ, Saturniadæ and Agliadæ), is shown by a table published by me separating the genera of Attacinæ as the Radius is 3 or 4 branched. For a study of the whole insect leads me to regard the 3-branched *Philosamia* as a specialization of the 4-branched *Attacus* with which its phylogeny probably lies, rather than as nearly related to *Samia*; with which it has the suppression of III_3 in common.

Leaving the Attacinæ, with open cell, we come to the more generalized Saturnianæ* with the crossvein present and, so far as I can see, almost everywhere at least partially functional. Undoubtedly here is a

* It is more correct to commence with the more generalized forms, but I have become convinced that in the Lepidoptera it will always be more practical to adhere to the Linnean sequence, and this for a variety of reasons, among them this, that the contrary course will never be adopted by "collectors," who will thus be deprived of the light thrown or reflected by "scientists."

gap. The gradual stages of disintegration of the crossvein, such as I found in the Pierinæ and Nymphalinæ I have not so distinctly met with in the Emperor Moths. But the first step towards this stage is marked in the Saturnianæ and has already everywhere attained full expression. It is the conversion of the crossvein between IV2 and IV1 into the physiological base of IV2, so that the crossvein proper seems to lie merely between IV2 and IV3 and we can classify the Saturnianæ under the rubric: vein IV2 continuous or on a long stem with vein IV1. That the Saturnianæ have attained a high relative grade of specialization is seen by the loss of vein VIII on secondaries and the absorption of the radical veins on primaries. They have lagged behind the Attacinæ in the first direction: the suppression of the Media and its system. One point more and I have done with this typical subfamily. In the Saturniades vein VIII appears as a loop to VII on primaries. In *Actias* and *Telea* (proving the relationship of the dissimilar appearing imagos) this vein VIII has an outer inferior spur or prolongation. Is this a trace of the vein VIII in its former position as a parallel vein? Or is it a trace of an absorbed additional vein? Or is it a sporadic, or extra-growth? We notice it in *Castnia*. Its isolated appearance in two Saturnian genera makes it remarkable. Misled by Mr. Meyrick's figures of Geometridæ* I at one time thought the curved internal vein of *Papilio* might correspond to the internal vein figured by him in *Venilia macularia*. But it seems not, since the vein figured by Mr. Meyrick does not exist in the Geometrid form.

Next, we come to the Hemileucinæ, and here is a case of disputed classification, a matter I try here to uncover, with the help of the annexed diagrams of neuration obtained by photographic process. Both Professor Comstock and Dr. Dyar unite my Hemileucinæ with my Automerinæ under one "family," which they call Hemileucidæ after Packard. The origin of this notion may be traced back to Grote and Robinson, who, in 1866, established the group Hemileucini with the same contents.† A glance at the figure of the neuration of *Hemileuca maia*, which may also be found in Professor Comstock's beautiful Manual, p. 342 (a book I regret to have only recently become acquainted with), shows that its condition is what we might expect from a more generalized Saturnian. On the secondaries vein VIII is retained, and the retention of this vein is a generalization and repeated everywhere. This affords no proof of the want of relationship between *Hemileuca* and *Saturnia*; if it did, it would equally imply a want of consanguinity

* Consult: Ill. Wochenschrift für Entomologie, Band II, No. 38.

† Ann. Lyc. Nat. Hist. Vol. VIII, 376, October, 1866.

with *Automeris*. But here it is evidently vein VIII which is added to what is, in its total pattern, in its flowing venation, its wide interspacing, its treatment of the Media and its system, its position of vein IV_2—in all these points—the wing of a Saturnian, not the wing of an Aglian. What the addition of vein VIII makes to the wing of an Aglian we see in *Citheronia*. The student will follow me here better by a glance at the figures given, in this way complying with Hamlet's request to look first on this picture and then on this. How impossible does it not seem, that a classification can be correct (and a classification which represents even approximately the phylogeny) which would derive the Automerid from the Hemileucid wing, or the reverse! Is it conceivable that the malleable Hemileucid wing should have stiffened into the Automerid? Or that the rigid wing of *Citheronia* should have produced both? Or to believe with Dyar, that the wing of *Aglia* could have become transformed into the wing of *Saturnia* and *Attacus*, while the very wing of *Aglia*, its pendant, the wing of *Automeris*, should break out with *Hemileuca*? For those who believe in the "more conservative modern classification" it will be no argument to appeal to Hübner and that this writer considered *maia* to be a *Saturnia*; and, in fact, we see that Hübner was often mistaken, such as Professor Smith never is. But, in spite of all his mistakes, we believe that here Hübner is quite right; right also, in the "Tentamen" and in the "Verzeichniss," in recognizing two main groups of the Emperor Moths, which we call Saturniadæ and Agliadæ, and that *Hemileuca* belongs to the first and *Automeris* to the last. We shall try to make this clearer by our remarks on the next family.

AGLIADÆ.

It is to Dr. Packard that we are indebted for calling our attention to the fact that *Aglia* is a specialized Citheronian, and this from other grounds than the neuration, grounds we must here pass over. Before taking up the neuration of the Agliadæ, we will revert for an instant to *Hemileuca* again. The vein we call III_{1+2} in *Hemileuca* springs from the Radius above the cell. In the Agliadæ this is the normal condition of affairs. Its point of emergence travels upwards a little in *Aglia*, as compared with *Automeris*, and herein is the latter the more generalized. But in *Saturnia* it has already been absorbed to a point of issuance from III_{3+4}, just before the apex. Now, this is just what we would expect in a generalized Saturnian, and it follows naturally the presence of vein VIII in *Hemileuca*. But the type of *Saturnia*, the long stem upon which IV_1 and IV_2 sit, i[illegible]dy f[illegible]developed in *Hemileuca*.

There remains, then, but the absorption of III1 + 2 on primaries, and the loss of VIII on secondaries to evolve out of *Hemileuca* the type of *Saturnia;* and this without violence and following the lines of evolution which we have shown to be followed by the lepidopterous wing. Now to form the Hemileucid wing out of the Citheronian or Automerid type we must have recourse to violence, and this violence is apparently not considered but committed by Professor Comstock and Dr. Dyar.

The neurational type of *Aglia* and *Automeris* is practically identical, so that their position is parallel to that of *Attacus* and *Saturnia.* We may consider them together. They differ exactly by characters on a line with the evolutionary advancement we have everywhere pointed out. In the *first* direction a hesitating and half-expressed step has been taken by *Aglia.* The cross-vein, *still uneven,* still distinctly reminiscent of its true character as a crossvein becomes oblique between IV2 and IV1. In all the Automerinæ from South America I have yet been able to study, the cross-vein is transverse as in *Automeris io.* The point of issuance of III1 + 2 varies somewhat, but little. In this, the *second* direction, as we have above seen, *Aglia* is again more specialized. But otherwise the wings are identical. Neither express any of the distinguishing features of the Saturnian type. Inasmuch as the first direction, the suppression of the Media, is everywhere less progressed, both *Aglia* and *Automeris* are more generalized than the Hemileucid and Saturnian type. In their progression they have lost vein VIII of secondaries, here passing *Hemileuca* by, while the absorption of the radial veins would have rested at the Hemileucid stage. These are all secondary lines of advancement, unequally entered upon. We conclude that *Aglia* represents *Automeris* in the Old World and that it is the more specialized type. Both have sprung from the same near ancestors, the same stem, whether independently, or together, or whether *Aglia* may be looked upon as the outcome of an Automerid form, we can only surmise. But there they are and they belong together, their sundering, by any system of classification, from their common stem, is an act of violence and equivalent to a denial of any lessons to be derived from the neuration, at least so long as their common characters cannot be explained away. We are confident that it is impossible and that the classification we propose is natural and in accordance with the facts.

It does not diminish the difficulty to multiply the families; if we, out of the six subfamily groups originally proposed by me, make, instead of two, the whole six figures as families in our books. Always will *Hemileuca, Saturnia* and *Attacus* come together, always will *Citheronia, Automeris* and *Aglia* coalesce upon the type of wing. That

there is a difference in the closeness of contact we have urged. This difference is the measure of their nearness to a common ancestor. Thus *Attacus* and *Saturnia* are close together, while *Hemileuca* stands apart a little, still sharing the common type of wing which is indicated by the long stem of the two upper branches of the Media. And *Aglia* and *Automeris* are, in an opposite way, quite nearly related; while *Citheronia* stands still further off from these and is much more by itself, though still exhibiting the Aglian type of wing, the absence of stem to the upper branches of the Media, the transverse cross vein, the stiff, equal distanced, parallel veins. To a brief review of what we have published about *Citheronia* we devote the rest of this paper.

The student must study with this paper what Dr. Dyar has written in Can. Ent., 1896, 303, and the phylogeny there given. The drawing there given is correct, except that I suppose the original Aglian stem (assumed to be represented by the existing Citheronian branch) has given off both *Aglia* and *Automeris*; whether together, or one after another, or whether *Aglia* be an outcome of Automerid-like ancestors, which I am now inclined to assume, I do not decide. My original view of the separation of the six into the two groups is here maintained. I placed *Hemileuca* parallel with *Citheronia*, or but slightly advanced from the difference in general type, from the common retention of vein VIII of secondaries. Above *Citheronia*, as having proceeded from the same stem I placed successively *Automeris* and *Aglia*, the latter being the most specialized. The antennal characters bear out this division. In the Aglian group the female antennæ are short and simple, with few exceptions in specialized forms. In *Attacus* and *Saturnia* they become pectinate. I consider *Citheronia* as specialized in peculiar directions, and as having lost much original character and added new; still, by the retention of vein VIII, as being, rather, the representative in direct line of the original stem. But this view is, for the moment at least, subordinate in importance to the correct placing of *Hemileuca*, to the breaking up of the assemblage of *Automeris* and *Hemileuca* by Grote and Robinson, Packard, Comstock and Dyar. This is the main classificatory result which I believed to have attained in my recent studies of the Emperor Moths. For, whether *Citheronia* represents the main branch (in assuming which I am not a little influenced by Dr. Packard's paper), or whether *Automeris*, is clearly of inferior value to the main fact, that *Aglia*, *Automeris* and *Citheronia* belong together, while *Attacus*, *Saturnia* and *Hemileuca* represent another, and, on the whole, more advanced phylogenetic line upon the same stem. The student

may consult also my illustrated paper in the "Verhandlungen der Gesellschaft Deutscher Naturforscher und Aerzte" 1896, p. 197. In a linear series we would arrange the generic types thus: *Attacus*, *Saturnia*, *Hemileuca*, *Aglia*, *Automeris*, *Citheronia*.

In a foot-note, Journ. N. Y. Ent. Soc., VI, 46, I have written that the crossvein becomes oblique in *Aglia* and *Citheronia*. As I recollect, I had in my mind to write *Eacles*, but a fresh study of the latter genus, and all the Citheronians now accessible to me, has led me to the conclusion that everywhere in this group the crossvein remains transverse. No steps that I can now clearly recognize as such have been taken, as in *Aglia*, towards an independence of IV2. But even were my former statement correct, the argument supposed to be drawn from it is futile. For the movement is secondary in its nature and would not indicate any necessary nearer connection between *Aglia* and *Citheronia*. What we want is primary character, underlying the general type of the wing and this we have found in the long stem of IV2 and IV1 in *Saturnia*, together with the other comparative characters here discussed, as opposed to the issuance of IV2 from the crossvein in *Aglia*, together with the equally opposing features above summarized.

We have above admitted that the peculiarly Citheronian type of the Agliadæ, stands at a greater distance from *Aglia* and *Automeris* than these two from each other. It remains here to point out these differences and emphasize the conformity to a common type of wing. The wing in the Citheronians has pursued a slightly varying form of specialization of the Media from the other groups of Emperor Moths, one that we meet on occasion again in the Day-Butterflies and also the Hawk Moths. How far this variation is caused by the mechanics of the wing, I cannot now enter upon. Vein IV1 travels up the lower edge of the Radius, and the extent of its absorption by the Radius is the measure of the specialization of the genera. These stand, in ascending order, *Eacles*, *Citheronia*, *Anisota*. I do not know the neuration of *Sphingicampa*, nor whether it bears out my formerly expressed idea that it stood nearer to *Eacles* than to *Citheronia*. It is probably a specialized form. But although the wings of Citheronians are on the whole perhaps more specialized, as compared with *Automeris*, and in a different way, we have more than a reminder of the Aglian and Automerid pattern. The Radius is four-branched, and this is the natural precusory stage of the three-branched, here the Aglian and Automerid, wing. In *Anisota* vein III1+2 has traveled up the Radius and is given off beyond the cell. In the median system vein IV2 inclines to the Radius, and vein IV3

comes into near contact with the Cubitus, thus following the course of specialization in the entire group, by which the middle branch of the Media becomes radial in disintegration. But the pattern remains distinctly Aglian, the veins are stiff, tend, even in the most highly specialized forms, to remain equidistant, there is no effort to lead to the Saturnian pattern, indeed there seems no possibility of a progression in this direction, vein IV1 having taken quite a contrary course, a course entered upon already by the most generalized form, *Eacles*. But this course is possible from the Aglian, not possible from the Saturnian types. Vein VIII of the secondaries is retained, while it is shortening. Knowing, as we do from Dyar's studies, that the larva conforms to the Saturniades type, it becomes a matter of comparative less importance whether we confer upon the Citheronians family rank. Under this general view of the position of *Citheronia*, we consider the slighter correspondences in venation with the Hawk Moths to stand in relation to the narrowing of the wings and the habit of pupating in the ground to have been separately acquired. The Citheronians have pursued a peculiar path in evolution and one that stands in relation with their comparatively limited geographical distribution. They seem confined, as long ago pointed by me, to America, east of the rocky backbone of the two continents.

From the clear exposition of Dyar, Can. Ent., 28, 303, it seems impossible to reconcile a phylogeny based on the larval tubercles of the Saturniades with the one proposed by me on the neuration. Taking the latter as the final appeal we are obliged to suppose, that *Attacus* and *Saturnia* on the one hand and *Aglia* on the other have independently acquired the tubercles on anal plate. According to the value placed by Dyar on these organs, I must agree that this seems impossible. On the other hand, I cannot find it probable, indeed, it scarcely seems to me possible, that *Aglia* (which, in the same wing pattern of venation, clearly represents a more specialized type than *Automeris*) should belong to the Saturnian branch and wing pattern, as a generalized type. Nor does it seem to me within the range of probability, that *Automeris* or *Citheronia* could have produced the wing pattern of *Hemileuca*. On our respective trees, the groups represented by *Hemileuca* and *Aglia* change places. The female antennæ of *Aglia*, *Automeris* and *Citheronia* are of one type, so far as I can see; also those of *Attacus*, *Saturnia* and *Hemileuca* hold together, both types appearing distinctive. *Hemileuca* is just what one would expect of a generalized Saturnian; *Aglia*, just what one could agree that a specialized Automerid might

be. Vein VIII on secondaries has been retained by the two "lowest" groups on the respective branches, *Hemileuca* and *Citheronia*, exactly as appears most natural, in my tree, wheras in Dyar's *Hemileuca* goes to the top. The association of *Hemileuca* and *Automeris* as equivalent groups by Dyar seems, from this point of view, impossible. The whole wing pattern of the Agliid branch on my tree holds together, with *Citheronia* as its slightly dissenting feature, while the whole wing pattern of my Saturnian branch holds together without any discordant element whatever, unless the presence of VIII in *Hemileuca* is one, but this does not prevent Dyar placing it with *Automeris*. So that it is possible, from the neuration, to admit of three "families:" Saturniadæ, Agliadæ, Citheroniadæ. Further than this we cannot go, and the matter must be left for more light. If *Aglia* belongs to the Saturnian branch and *Hemileuca* to the Automerid, then Dyar is correct, if not, then I am justified.

The strength of Dyar's argument and his system in general lies in the indifferent nature of the position of the tubercles. Where such ornaments or their details can be proven to be useful to the organism, adaptive, they are clearly secondary and their importance fails. I cannot judge of the value of the tubercle on the anal plate, but must take Dyar's word for it that it is primary. So we are at a deadlock. The pattern of the wing venation, not the position of the movable veins, is for me primary. In this case *Hemileuca* displays the Saturnian pattern. The presence of vein VIII on secondaries is subordinate in value to this. *Hemileuca*, from the pattern of neuration, can not, by any reasonable process, have either been derived from *Automeris*, or alongside of it, or represent its ancestor—the rôle Dyar expects to fill, since it is less specialized. Its capabilities are exceeded by one and all of these demands. *Automeris*, on the other hand, may very well have thrown off *Aglia*, indeed I believe that *Aglia* sprang from Automerid-like forms. I can also clearly see, that *Saturnia* must have sprung from Hemileucid-like forms. So different are *Saturnia* and *Aglia* they are with difficulty compared. *Citheronia*, while at the bottom, showing the Castnia-like pattern of *Aglia* and *Automeris*, presents a modification in the movement of vein IV1, analogous to the Sphingidæ, Pierids and *Nemeobius*. *Attacus* and *Saturnia* show the Nymphalid movement of the meridian branches, but add to it the Pierid and Lycænid specialization of the radial branches. *Rothschildia iacobaea* has the most specialized neuration of any lepidopteron known to me. On another line, the common White butterfly competes with it.

Not only does *Rothschildia* carry the Nymphalid and Lycænid secondary movement of the veins to an extreme, but it shows also the subprimary Papilionid specialization of the hindwings, the inner margin hollowed out, and VIII vanished, characters evinced by the Attacinæ. No better proof can be offered to sustain the thesis, that rank is a relative conception and that corresponding specializations are worked out upon different phylogenetic lines. And we see that it is inevitable, that systematists like Mr. Scudder, who erect an imaginary sequence upon the fastening of the chrysalis, or other congruous class of facts, and finding some example, like *Oeneis*, which meets their fancied requirements, proceed to place this "at the head" of the lepidoptera, must be doomed to disappointment.

The arrangement for the new check list may be provisionally laid down here, so far as embraced, by the two parts of my revision now published. I may say, that, so far as my preliminary studies are concerned, I believe to recognize eight superfamilies in the Lepidoptera: Papilionides, Hesperiades, Sphingides, Saturniades, Bombycides (Agrotides), Tineides, Micropterygides and Hepialides. I would keep as near as may be to the Linnean sequence, transferring the Sesiadæ and Anthroceridæ from the Sphinges to the Tineides; and the Cossidæ, Apodidæ, Ptychopsychidæ and Psychidæ from the Bombyces to the Tineides.

To sum up: In *Hemileuca*, as in *Saturnia*, veins IV_1 and IV_2 are furcate at the extremity of a long stem. This stem is morphologically the extension of that piece of the cross-vein lying between IV_1 and the Radius. Vein IV_1 is thus prevented absolutely from ascending the Radius, as it can in *Aglia* and *Automeris*, where no such extension takes place or offers to take place, and does in *Citheronia*. The neuration here demands, in a positive manner, the classification advanced by me. No looking at the neuration "broadly," no trifling as to terms or the theoretical value of certain changes in the movable veins, can ever obscure this point, which proves that *Aglia* can never be brought into a connection, either as a derived or original representative form, with the typical Saturnians. The dichotomy proposed by me is borne out by all exotic Saturnians I have been able to study. On the other hand, the reference of *Endromis* to the Sphingides is not positively demanded by the neuration; a shorter vein, connecting II and III, and bending down II, near base of hindwings is present in *Bombyx mori*. From uncompleted studies in the Lachneidæ, this may not be homologous. The union is at most not contradicted strongly. It becomes

somewhat probable by the extension of the movable pupa from the web, a character not found in the Bombycides (Agrotides).

A. PAPILIONIDES.

Fam.	I.	PARNASSIIDÆ.	Type. *P. apollo.*
"	II.	PAPILIONIDÆ.	" *P. machaon.*

B. HESPERIADES.

Fam.	III.	PIERIDÆ.	Type. *P. rapæ.*
"	IV.	NYMPHALIDÆ.	" *N. lucilla.*
"	V.	AGAPETIDÆ.	" *A. galathea.*
"	VI.	LIMNADIDÆ.	" *L. chrysippus.*
"	VII.	LIBYTHEIDÆ.	" *L. celtis.*
"	VIII.	NEMEOBIIDÆ.	" *N. lucina.*
"	IX.	RIODINIDÆ	" *R. lysippus.*
"	X.	LYCÆNIDÆ.	" *L. endymion* (teste Scudder.)
"	XI.	MEGATHYMIDÆ.	" *M. yuccæ.*
"	XII.	HESPERIADÆ.	" *H. malvæ.*

C. SPHINGIDES.

Fam.	XIII.	ENDROMIDIDÆ.	Type. *E. versicolor.*
"	XIV.	SPHINGIDÆ.	" *S. ligustri.*

D. SATURNIADES.

Fam.	XV.	SATURNIADÆ.	Type. *S. pavonia maior.*
"	XVI.	AGLIADÆ.	" *A. tau.*
"	XVII.	CITHERONIADÆ	" *C. regalis.*

EXPLANATIONS OF PLATES II AND III.

The accompanying figures of the neuration of Saturniades are obtained by photographic process and may thus be relied upon for exactness. The numbering of the veins is in accordance with the corrected Redtenbacher-Comstock system as applied to the Lepidoptera. III = Radial veins; IV = Median veins; V = Cubital veins.

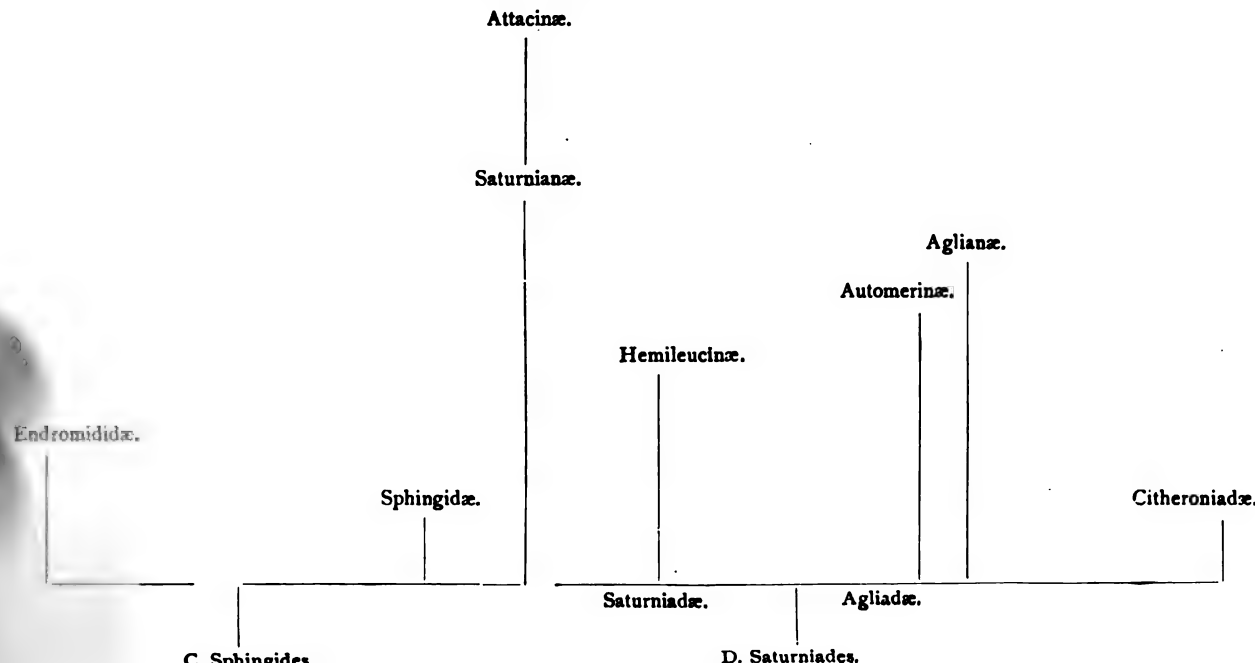
Fig. 1.—*Saturnia pavonia maior.* This and the succeeding represent the Saturnian type, in which IV2 becomes continuous with IV1. The crossvein appears to obtain merely between IV2 and IV1 the middle branch of the Media becomes Radial. In the Attacinæ, here not represented, the crossvein vanishes.

Fig. 2.—*Hemileuca maia.*—The same Saturnian type is exhibited with the secondary distinctions that vein III1+2 springs from the Radius above the cell. In *Saturnia* it has travelled upwards to a point just before apex; by this character *Hemileuca* is more generalized. Also with the difference that vein VIII of hind wings, suppressed in *Attacus* and *Saturnia*, is here retained. Else it equals *Saturnia.*

Fig. 3.—*Aglia tau.* This and the succeeding figure represent the Aglian type of wing. Attention is called to the oblique outward direction of the still uneven portion of the crossvein between IV2 and IV1, the first indication of a secondary movement tending to the disintegration of the system of the Media.

Fig. 4.—*Automeris io.* The crossvein is transverse, and no indication of the secondary movement of the crossvein in *Aglia* is observed. The point of issue of III1+2 is removed further towards the base of the wing. In these two points the Automerid wing lags behind, or is more generalized, than the typical Aglian wing. Else it equals *Aglia.*

PROPOSED GENEALOGICAL TREES OF THE HAWK AND EMPEROR MOTHS WITH REFERENCE CHIEFLY TO THE NEURATION.



NOTES ON THE DEVELOPMENT OF DRASTERIA ERECHTEA (Cramer).*

PLATES IV AND V.

BY F. M. WEBSTER.

The preparatory stages of this species have been studied by Professor French,† and I have no expectation of adding anything to his careful and painstaking work. Mr. M. V. Slingerland‡ has also reared the species from the egg, but his studies relate more especially to the characters of the adults and those of closely allied species and varieties. My own studies were begun with the idea of watching the individual development of the young as closely as I was able, gleaning any points regarding such development as was possible, and which had not been already recorded. I can hardly claim that the work was premeditated, as, but for what might be termed a bit of carelessness, the study would have never been commenced.

September 24th, I captured a female moth and, killing her as was supposed, placed her on the setting board. On the following day it was found that she had revived and though unable to release herself, had struggled about and completely ruined herself so far as a desirable specimen was concerned (which I later had cause to regret), and, in the meanwhile, deposited a number of eggs. As she was captured among grass and clover, it was probably during the performance of that duty that she fell into my hands, and the labor was finished while pinned upon the setting board.

The eggs were of a malachite green, as described by Professor French, but I found them somewhat more flattened at the poles than he has described, though the drawings made from alcoholic specimens hardly represent them as they appear when freshly deposited, the flattening at the poles being closely illustrated by the appearance of the upper end in the middle of the three illustrations on Plate IV, the eggs from which drawing was made being those deposited by an unmated female.

The eggs were placed near a bunch of grass, transplanted to the vivarium, but they hatched while no one was about the insectary to ob-

*Read before Section "F," Zoology, of A.A.A.S., Detroit, Michigan, August 10 1897.

†Papilio, Vol. IV, pp. 148–149.

‡Insect Life, Vol. V, pp. 87–88.

serve them, and it was not until several days that the young were found on the blades of timothy. On October 10th, however, they were found, and at that time had precisely the appearance that French ascribes to the larvæ before first moult, viz., the two extremities of the body were of a pinkish color while the intermediate portion was of a greenish hue, which I ascribed at the time to the color of the food showing through the almost transparent walls of the body. In this case, I believe the egg stage was about twelve days, instead of five days, as observed by Professor French, as the eggs had not hatched on October 8th, and the larvæ did not show the reddish stripes, which indicate the period following first moult, on October 12th, but did show them on the 14th. This would give an egg period of twelve days, and the larval period to first moult five or six days, instead of three, as Professor French found it to be at Carbondale, Illinois. Was this difference due to latitude or to the advanced season when my observations were made? This will certainly be an interesting question. The very young larvæ have every appearance of belonging to the Geometridæ, and when feeding on the blades of grass, eat the substance of the blades only, leaving the veins and the epidermis almost intact. After the first moult they begin to eat through the leaves and along the edges, causing cleanly cut notches. The grass plant was now enclosed by a glass cylinder placed in a vertical position, and the larvæ, by jerking the posterior part of the body while hanging to the grass blades by the feet, threw the excreta away from them, and it could be observed in abundance on the inside of the glass, where it had been caught and held by the moisture collected there. If in any way disturbed, however, they hang by the penultimate and anal pairs of feet and wave the body about frantically, and then remain quiet, clinging by the three pairs of prolegs, the body arched nearly in the form of the letter S, the anterior feet and legs bent backward beneath the body, which is usually placed parallel with the blade on which it is stationed, but not holding to or touching it. On November 4th, some of the larvæ were observed in the act of moulting, the first time I had observed them to do so, though this was doubtless on account of my not having been able to give them daily attention. It will be observed that these larvæ were now a few days less than a month old. Professor French found the date of last moult to vary from 19 to 25 days from hatching.

My larvæ had now become reduced to six, and by the 19th of November, these varied so greatly in size that I was led to measure the lot, and by so doing found that there were really two series, in point of

size, each series comprising three individuals and measuring in length as follows: 1 inch; $1\frac{1}{16}$ inches; $1\frac{1}{8}$ inches, and $\frac{11}{16}$ inch; $\frac{13}{16}$ inch; and $\frac{3}{4}$ inch. The larva measuring $\frac{11}{16}$ inch moulted on November 19th.

On account of being almost continually absent from home, I was now compelled to turn the larvæ over to my assistant, Mr. C. W. Mally, who gave them nearly all the attention they had throughout the remainder of the time that they were under observation.

After December 1, the larvæ appeared to increase in size very rapidly, the larger ones becoming lighter in color, and could hardly be distinguished from the yellowish and brown blades of grass, more or less eaten, and along which they would stretch themselves and remain for a long time, occasionally moving the head from side to side with a sort of trembling motion. This protective coloration had been observed from the time of the first moult of the larvæ, the brown stripes and greenish background blending with the discoloration of the part of the blades of grass that had been attacked, while the lighter green corresponded with the portions of uneaten epidermis, backed by the green color of the blades behind them. As the larvæ became more aged the colors changed to a more decided brown hue, intermingled with yellowish, and with this change there came a decided disposition to pass more of the time nearer the base of the grass plants, where these colors predominated, than higher up, where the prevailing color was a uniform green. Earlier in the life of the larvæ, the upper portion of the blades of grass were more generally attacked, none being cut off from below and falling down to turn to yellow and brown, while now at this later period, many blades were eaten only for a short distance above the ground and falling down took on the yellow and brown. Whatever might have caused this change of habit, it was certainly not on account of the lower portions of the blades being more tender and succulent, though with the continually increasing bulk of the individual larva there would naturally follow a greater aversion to activity, and a less disposition to climb to the higher portion of the blades of grass. It seems to me that we here have a most interesting case of adaptation, and one that was not anticipated when these observations began.

On December 3 the three larger larvæ began to show signs of uneasiness, crawling about the cages, and again stretched at full length on the side of the same, and again down among the grass, feeding.

December 7, one of the larger larva, which will be hereafter designated as No. 1, and the adult and chrysalis is shown under this number in the illustrations, settled down in a corner of the breeding cage, fas-

tened a few silky threads over itself, a labor which was completed the following day, and passed into the pupal stage, having passed a larval period of, approximately, sixty-one days, and seventy-four days from time of deposition of the egg.

The remaining two of the three larger larvæ crawled down to the bottom of the breeding cage and began constructing their cocoons, but died before pupating. The imago of larva No. 1, issued January 13, 1897, thus giving a pupal period of thirty-five days, and one hundred and nine days from date of oviposition.

Of the series of three smaller larvæ, after December 4, two of them increased in size very rapidly, and, in fact, seemed to be gaining upon those of the first series, while the third, which, so far as could be determined, had continued to be the smaller since the time of measurement on November 19, did not increase in size so rapidly. While the two just mentioned became slightly lighter in color, precisely as had the three larger ones, this one continued to be much smaller and darker in color, the blackish stripes being quite conspicuous.

The first larva of the three smaller ones to pupate will be designated as No. 2, the moth and cocoon beeing so numbered in the accompanying illustration. This was one of the two light colored larvæ of this series, and began fastening the blades of grass together on the night of December 8, the imago issuing January 19, 1897, after a pupal period of forty-one days, and one hundred and fifteen days from date of oviposition of the egg.

The third larva reared to the adult moth will be designated as No. 3, including adult and cocoon. This was second of the lighter colored of the second and smaller series, and began pupating during the night of December 9, but did not finish doing so until the following day, leaving the blades of grass which it had begun fastening together, with the evident intention of constructing a cocoon therefrom, and appropriated a bit of cotton that happened to be within reach, and constructed its cocoon from that, thus forsaking a natural material for an artificial, and seemingly one of more practical utility. The imago appeared January 23, 1897, after a pupal period of forty-four days, and one hundred and seven days from the deposition of the egg.

The third of this series and the smallest of the larvæ studied, escaped from its breeding cage, December 15, evidently when searching about for a satisfactory place in which to spin its cocoon. It continued to be of a darker color throughout, but had attained to the same size as its fellows. Later, an adult of this species was found dead in the insec-

tary, during the latter part of January, and as this was the only example found and the date of finding corresponds so nearly with that of the appearance of the remainder of the whole series, together with the fact that there was hardly a possibility of a larva having been unintentionally introduced from without, there is little doubt but that this was the imago from the larva which had escaped from its breeding cage. It was very similar to No. 1, being about the same size, but somewhat darker in color. The mother of the whole three being lighter and of the type of No. 2.

About October 10, 1896, Mr. Mally brought in from the fields three larvæ, seemingly nearly full grown, and these were placed on clover and blue grass in a breeding cage in the insectary. About October 22, all three of these formed cocoons similar to the one shown in No. 4, which is composed of three clover leaflets fastened together, while still attached to the petiole, thus making a neat and deceptive case, having three quite conspicuous angles. The weight of the pupa of course caused them to turn downward, but even then they appeared like a drooping, withered leaf, and for this reason very apt to be overlooked. One of these three pupæ was preserved for a cabinet specimen, the second died, while the third transformed December 6, and is shown with cocoon in No. 4.

Of two larvæ brought in from the fields and placed in jelly cups about October 21, one formed a very slight cocoon of silk as shown in No. 5, and the other fastened blades of grass together, as shown in No. 6, notwithstanding both were supplied with grass for food, and hence both had the same material from which to construct their cocoons. The imagos both appeared December 18, 1896.

The latitude of Wooster, Ohio, where these experiments were carried on, is 40° 48′, while that of Carbondale, Illinois, where Professor French studied the species, is about 37° 45′. It will be observed that with him the egg period was less than half as long as with me, while with him the species developed in from 41 to 66 days from the egg, the majority going from 48 to 53 days, with me this period varied from 107 to 115 days. The eggs which furnished the basis for his breedings were deposited August 13, and those which I followed were deposited on September 24 or 25.

I am quite certain that, here in northern Ohio, the insect goes into the winter in the larval stage, as I have observed nearly full grown larvæ crawling about after the middle of November, though hibernation may also occur with pupæ or even adults. In southern Ohio, I have observed seemingly freshly emerged adults early in April. All of my

larvæ upon which these studies are based were kept in the insectary, and in a temperature varying probably from 60° to 75° Fah.

The species is a grass as well as a clover insect, as will be observed from the foregoing, and as the striped body of the larvæ would indicate, but it would seem that the clover leaf is especially desirable as material for constructing the cocoon, and it is just possible that the lack of this building material would account for the great variation in tastes in selecting such as was at hand to supply the place of clover leaves, thus the better illustrating natural selection.

The variation in rapidity of growth I am totally unable to account for, as there was an abundance of food, and the larvæ were never crowded. With the individual variation in size and time required for development in the larvæ, as well as their difference in coloration, together with the equally striking difference in the appearance of the adult, it would seem that in this case at least individual variation offered no very narrow basis for the evolution of forms, which, under a favorable environment, might still further progress through varieties to species. That this may have actually transpired, is witnessed by the exceedingly close resemblance between *Drasteria erechtea* Cram. and *D. crassiuscula* Haw., either one of which might have given origin to the other, through the same course of evolution as that, seemingly, being followed at present by varieties *agricola* G. & R., *ochrea* Grt., and *distincta* Neum., the two latter being considered by Mr. Slingerland as varieties of *D. crassiuscula*. It only requires that these varieties become sterile to each other and the parent stock when crossed, in order for them to become species, as valid as either of the two just mentioned.

EXPLANATION OF PLATES IV AND V.

Fig. 1. *Drasteria erechtea* and cocoon.
" 2. " " " "
" 3. " " " "
" 4. " " " "
" 5. " " " "
" 6. " " " "
" 7. Eggs, enlarged (pl. IV).
" 8. Larva, enlarged (pl. V).

NEW AMERICAN MOTHS AND SYNONYMICAL NOTES.

By Harrison G. Dyar, Ph.D.

LITHOSIIDÆ.

Hyproprepia mexicana *Druce.*

1885. *Lithosia mexicana* Druce, Biol. Cent. Am. Lep. I, 131, pl. 13 ff 2, 3.
1892. *Crambidia mexicana* Kirby, Cat. Lep. Het. I, 338.

Dark mouse gray, a narrow yellow line on costa, through middle of cell to margin and along the internal margin, just a trace on the outer half of submedian fold. Secondaries all gray. Sides and posterior part of thorax and tip of abdomen pink.

Two specimens, Chiricahua Mts., Arizona (H. G. Hubbard). Coll. U. S. Nat. Mus.

More heavily shaded with gray than in the specimen figured by Druce, but doubtless conspecific.

Bruceia hubbardi, sp. nov.

Similar to *B. pulverina* Neum., but smaller. The colors are the same in both species but the diffuse dark powderings of fore wings are differently shaped. In *hubbardi* there is a series of terminal dots, absent in *pulverina*, and there is a distinct angular line resting on anal angle where in *pulverina* there is only a diffuse powdering. Expanse, 22–25 mm.

1 ♂, 2 ♀ ♀ Chiricahua Mts., Arizona (H. G. Hubbard), July 4. Type no. 3840, U. S. Nat. Mus.

Crambidia lithosioides, sp. nov.

Dark slate gray, secondaries lighter at base. A very narrow pale yellow line along costa almost to apex, along anterior edge of collar, broken centrally, and on posterior orbits faintly; otherwise immaculate. Expanse, 21 mm.

One ♀, Texas. (Belfrage.) Type No. 3784, U. S. Nat. Mus.

Resembles *Lithosia bicolor.*

Crambidia uniformis, sp. nov.

Dark slate gray, all the veins of primaries finely lined in dull-ocherous; secondaries and abdomen a shade paler gray. Expanse, 19 mm.

One ♀, Washington, D. C. (F. C. Pratt). Type No. 3790, U. S. Nat. Mus.

Size and appearance of *C. lithosioides*, but without the ocherous costa.

Palpidia, gen. nov.

Primaries 12-veined, median 4-branched, veins 3 and 4 on a short stalk, 7 to 9 stalked, 10 from the apex of the cell; 11 from sub-costal. Secondaries 8-veined,

median 3-branched, 3 and 4 stalked, 5 from the cross-vein, weak, 6 and 7 from the apex of the cell, 8 joined to subcostal for one-third of the length of the cell. Frenulum divided (♀).

Eyes large, no ocelli; antennæ simple (♀), palpi long, obliquely ascending twice as long as the head and rising above the vertex, second joint long, closely scaled, third distinct, small. Body slender, legs with long spurs, two pair on the hind tibæ; wings long, narrow, the costa nearly straight but depressed at apical third, outer margin straight, curved at anal angle; secondaries considerably shorter than primaries.

In the synoptic table falls with *Tantura* Kirb., but this genus possesses ocelli and must be removed to the Noctuidæ (see later in this article).

Palpidia pallidior, sp. nov.

Pale ocherous, veins pale ocherous, all the interspaces thickly irrorate with black scales. Secondaries whitish.

One ♀. Cocoanut Grove, Florida (E. A. Schwarz). Type No. 3783, U. S. Nat. Mus.

Resembles *Crambidia pallida* Pack.

EUCHROMIIDÆ.

Lycomorpha *Harris.*

The account of this genus by Neumoegen and Dyar (Journ. N. Y. Ent. Soc., I, 102) contains two important errors. We did not observe that vein 8 was present on the hind wings of *coccinea* Hy. Edw., having only examined the type without removing it from the drawer, and hence wrongly allowed it to remain in *Lycomorpha*. We mistook for *L. fulgens* Edw. the specimens which stand in the Edwards collection as *Ptychoglene æqualis* and described these. It will be noticed that our description contradicts Edwards' original one (Papilio I, 116). These specimens bear a label, I think, in Mr. Schaus' handwriting, but they do not belong to *Ptychoglene*, as vein 8 of secondaries is absent; moreover they do not fit Walker's description of *P. æqualis*, as the costal edge is not black and the thorax is red instead of black. I propose to call them *Lycomorpha schausi*.

Lycomorpha pulchra, sp. nov.

Head and body black; thorax above, including collar and patagia, red. Wings bright red, the fringes of both narrowly black and a very narrow black line on the outer fourth of costa and internal margin of primaries. Expanse, 25 mm.

1 ♂, Texas (Belfrage). Type No. 3786, U. S. Nat. Mus.

Of the species described as *Lycomorpha*, *sinuata* and *coccinea* Hy. Edw. belong to *Ptychoglene* (Arctiidæ); *mexicana* Druce, *constans*,

rata, *latercula* and *fusca* Hy. Edw. to Triprocris; *marginata*, *notha* Hy. Edw. and *centralis* Walk. to *Pyromorpha* (Pyromorphidæ); *augusta* Hy. Edw. is a Euchromian, but it does not belong to *Lycomorpha* as vein 10 is stalked on fore wings and 5 is present on hind wings. It may form a new genus when this family is revised, or may come in some genus at present unknown to me. It falls into *Ctenucha* in the synopsis. From the description I think *regia* Schaus must go with it. Of the other species I have seen but half, and they may not all be congeneric. Judging from the above, they may belong anywhere in five genera of three families, representing two super-families. But, assuming them to be congeneric, they separate as follows. Those which I have reason to believe correctly placed generically are preceded by an asterisk. Species not placed, *chlora* Schauf.

Synopsis of Lycomorpha.

1. Thorax all black.. 2
   Thorax black; patagia red or yellow................................... 3
   Thorax all red.. 8
2. Secondaries dull orange, with narrow black margin..............**teos** *Schaus.*
   Secondaries with a broad black margin..............**viridiceps** *Feld & Rog.*
3. Primaries with black reaching from outer margin to near middle of wing..... 4
   Black border of primaries covering about one-third of wing................ 6
   Black border confined to the fringe...................................... 7
4. Outer black in the form of a border...................................... 5
   Outer black a longitudinal band.........................***fumata** *Möschl.*
5. Primaries orange at base...................................***pholus** *Dru.*
   Primaries red at base.....................................***miniata** *Pack.*
6. Secondaries black almost to costal margin............**contermina** *Hy. Edw.*
   Secondaries black on outer half.......................**desertus** ♂ *Hy. Edw.*
7. Red; secondaries nearly all black....................***fulgens** *Hy. Edw.*
   Orange; secondaries with fringe only black...............**anacreon** *Druce.*
8. Primaries red, with rather broad outer black border..........***schausi** *Dyar.*
   Primaries red, with black fringe... 9
   Primaries orange, with two transverse black bands....**desertus** ♀ *Hy. Edw.*
9. Secondaries with outer black border covering half or more of wing..***grotei** *Pack.*
   Secondaries with only the fringe black.......................***pulchra** *Dyar.*

ARCTIIDÆ.

In my revision of genera (Can. Ent. XXIX, 212), I included two with "vein 8 of secondaries wanting." This is not strictly the case in the sense that vein 8 is wanting in the Euchromiidæ by coalescence with 7, for in the series culminating in *Eupseudosoma* and *Eucereon* it has disappeared by atrophy, apparently, while in *Bertholdia* it is vein 6

that has disappeared by coalescence with 7. In some species of this group vein 8 coalesces with 7 to end of cell, producing the appearance of the absence of vein 8. These two groups of Phægopterids are thus essentially Arctian, though apparently showing the Euchromian structure.

Bertholdia was erected by Mr. Schaus in this Journal (IV, 137) with type *specularis* H. S., containing three species. These are superficially recognizable by the large triangular vitreous patch on costa, but other species without this mark must ultimately come in the genus. Mr. Schaus has kindly given me a number of specimens of *Bertholdia*, among which I recognize a new form, apparently uncharacterized.

Bertholdia schausiana, sp. nov.

Intermediate between *specularis* and *trigona*. Primaries lead color, shaded with pink more or less, especially toward anal angle, dotted with black. Costa red, except at the vitreous patch, where it is yellow. The patch is excavated superiorly between vein 6 and costa, produced outward in the interspace 5–6 or simply angled, the lower border nearly straight, lightly shaded with yellow, the veins black dotted. The shape is most like *trigona* but distinctly angled in the interspace 5–6 and not pointed below. Basal yellow spots absent, or one small one present. Body and hind wings as in *trigona*. Expanse, 33–39 mm.

1 ♂, 3 ♀ ♀ from Mr. Schaus without locality. (Coll. Dyar.)

Synopsis of Species.

(Group 1 with large vitreous patch.)

1. Secondaries vitreous with gray outer border .... **specularis** *H. S.*
   Secondaries white, without gray border................................. 2
2. Primaries with white subterminal line.................. **albipunctata** *Schaus.*
   Primaries without this line.. 3
3. Subapical patch rounded below, scarcely crossing vein 4; basal spots reduced **schausiana** *Dyar.*
   Subapical patch pointed below to vein 3, or further expanding downward; basal spots usually expanded ....**trigona** *Grote.*

Gorgonidia, gen. nov.

Primaries with median vein 4 branched, cross vein of cell slightly concave, 6 from the apex of cell, 7–10 stalked; secondaries with vein 5 absent, 6 and 7 stalked, 8 joining the subcostal for over half the length of the cell. Wing long, produced, the secondaries small, trigonate. Palpi robust, not reaching vertex of head, first and second joints subequal, third minute. Ocelli touching the eye. Male antennæ serrate ciliate. Two pair of spurs on hind tibiæ.

The male has a stridulating organ on the thorax like that of the Asiatic genus Dionychopus, *i. e.*, *Spilosoma* (?) *nivens* Ménét. of Kirby's catalogue. (See Psyche, VII, 415, for description.)

Gorgonidia mirabilior, sp. nov.

Primaries vermilion red, crossed from the costal margin nearly to the middle by three yellow bands, narrowing inferiorly and edged with black except below; an elongated slate colored patch beyond the cell reaching the margin, sharply truncate basally, its lower inner angle produced to join a large rounded similarly colored patch which rests on the anal angle separated from the edge by a narrow red line and reaching above to vein 2 and basally to near the middle of the wing. Secondaries pinkish red, vermilion on costa and internal margin. Body vermilion, ocherous tinted on head and front of thorax; posterior edge of collar pink in the middle. Posterior edges of abdominal segments below narrowly white. Femora, tibiae and tarsi black, lined and powdered with white.

1 ♂, Piches & Perene Vs., 2,000–3,000 feet, Peru. (Soc. Geog. de Lima). Type No. 3791, U. S. Nat. Mus.

Closely allied to *Zatrephes buckleyi* Druce from Ecuador, and *Z. garleppi* Druce from Bolivia, which will also come in this genus.

Trichromia neretina, sp. nov.

Head dark ochre yellow on vertex, front purplish brown. Thorax purple brown; abdomen bright red dorsally, pale yellow below; legs pale yellow, fore femora bright red in tront, tibiæ and tarsi outwardly ocherous. Fore wings purplish brown, a yellow band from middle of costa to middle of outer margin, very narrow and dislocated (at vein 4) centrally, wide on the margins and running very narrowly along costa, more widely along outer margin to apex, cutting off the apical portion of the ground color into a rounded spot. The ground color is darkened where it joins the yellow. Secondaries straw yellow, tinted with ochre on the margins. Below as above, but the dark marks fainter, the basal patch pale and diluted with pink, the apical one more uniformly slaty. Expanse, 27 mm.

1 ♂, Piches & Perene Vs., Peru, 2,000–3,000 feet. (Soc. Geog. de Lima.) Type No. 3792, U. S. Nat. Mus.

Very similar to *Neritos repanda* Walk., but entirely without the sex mark.

Trichromia and *Neritos* may probably be separated by the sex mark, if not otherwise; but at present the species are mixed and I list them together below. Six of the species listed by Kirby seem not congeneric. I have not examined specimens, but think that *amastris* and *asana* Druce, as well as *cutheans* Druce (described since the catalogue) will fall near, if not in *Bertholdia* Schaus.

Synopsis of the similar species of Trichromia and Neritos.

1. Secondaries dark brown 2
   Secondaries pale yellow or pink.. 4
2. Yellow band of primaries broken in the middle.................**onytes** *Cr.*
   Yellow band crossing the wing.. 3
3. Abdomen dark, head red.......................................**psamas** *Cr.*
   Abdomen red above, head yellow............................**sithnides** *Druce.*

4. Yellow band of primaries crossing the wing 5
   Yellow band broken in the middle 9
5. Abdomen red or pink above 6
   Abdomen yellow 8
6. Head yellow, secondaries pink .... **patara** *Druce.*
   Head ocherous on vertex only; secondaries yellow 7
   Head reddish brown, secondaries yellow .... **samos** *Druce.*
7. Male with elliptical sex mark near base of fore wing .... **repanda** *Wlk.*
   Male without a sex mark .... **neretina** *Dyar.*
8. Head yellow .... **tipolis** *Druce.*
   Head gray .... **pandera** *Schaus.*
9. Costal spot yellow .... **flavoroseus** *Walk.*
   Costal spot broadly centered with brown .... **cotes** *Druce.*

Trichromia is not a Lithosian, as placed in Kirby's catalogue, as ocelli are present. The neuration of the species here described is as follows:

Primaries with 4-branched median, cross-vein of cell strongly angulated, forming a right angle, 6 from the apex, 7–10 stalked, 10 given off before 7, 11 close to apex of cell, 12 from base. Secondaries with two internal veins, median 3-branched, veins 3 and 4 on a long stalk, 5 absent, cross vein angled, 6 and 7 on a long stalk, 8 joining the subcostal for only about one-third of the cell, curving and rather remote from 7, strong. Tibial spurs normal, small. The ocellus is pale, situated in a black ring which is about as wide as the diameter of the ocellus itself and does not touch the eye.

Pygarctia muricolor, sp. nov.

Fore wing mouse gray with a slight bronzy reflection, translucent except along the margins and apically; hind wing translucent grayish, darker along the outer margin, pale at the anal angle. Head dark gray in front, vertex ochre yellow; collar mouse gray, narrowly edged with ochre behind; thorax gray, the edges of the patagia a shade lighter; below ocherous, including coxæ; legs gray. Abdomen buff, a dorsal row of small dots and a rather broad lateral band mouse gray. Expanse, 41 mm.

1 ♂, Chiricahua Mts., Arizona (H. G. Hubbard). Type No. 3787, U. S. Nat. Mus.

To give a wider comparison with southern forms this species may be provisionally placed in the genus *Opharus* Walk. on superficial resemblance. The following are its structural characters:

Accesory cell present, veins 7–10 from its apex, 8 and 9 stalked; 8 of secondaries joining cell for half its length, faint at the tip; no veins absent. Palpi oblique, porrect, not reaching the vertex, first and second joints subequal, third half of the second; tibial spurs normal, short. Body slender; antennæ long; hind wings rather large.

Assuming the described species of *Opharus* to be congeneric, they would separate as follows:

1. Abdomen continuously marked with orange or yellow, not transversely banded, ... 2
Abdomen not continuously orange, transversely banded or spotted with pale, 6
Abdominal without marks, dark 11
2. Abdomen dark dorsally .... **basalis** *Walk.*
Abdomen ocherous dorsally 3
2. Abdomen with lateral spots 4
Abdomen with a lateral band 5
4. Secondaries unicolorous, translucent at base .... **euchætiformis** *Hy. Edw.*
Secondaries ocherous on basal half .... **ruficollis** *Druce.*
5. Abdomen blackish below .... **gemma** *Schaus.*
Abdomen ocherous below .... **muricolor** *Dyar.*
6 Abdomen yellow or red, transversely black banded 7
Abdomen dark brown, spotted with testaceous or white 9
7. Secondaries brownish 8
Secondaries pink on internal margin .... **rhodosoma** *Butl.*
8. Large, two yellow dots on head .... **gigas** *Dogn.*
Smaller, thorax with small blue dots .... **albipunctatus** *Druce.*
9. Abdomen with testaceous spots on the sides .... **procrioides** *Walk.*
Abdomen banded with yellowish and with white spots .... **mundator** *Druce.*
Abdomen with white spots only 10
10. Two lateral rows of white spots on abdomen .... **tristis** *Schaus.*
One such lateral row .... **dolens** *Druce.*
11. Primaries brown .... **carbonarius** *Dogn.*
Primaries gray 12
12. A darker shade crossing the cell .... **morosus** *Schaus.*
Primaries uniform dark gray .... **lugubris** *Schaus.*

Ptychoglene flammans, sp. nov.

Deep bluish black. Fore wings bright scarlet, the outer margin broadly black, broadest at anal angle and twice inwardly waved, namely at submedian and discal folds; inner margin narrowly lined with black. Costal edge of secondaries broadly red on basal two-thirds. Below as above, the outer border of primaries straighter within. Expanse, 31 mm.

2 ♂♂. Chiricahua Mts., Arizona (H. G. Hubbard). Type No. 3785, U. S. Nat. Mus.

Apparently allied to *phrada* Druce, but the border of primaries is irregular.

Ptychoglene has the venation of *Eubaphe*, but differs in the longer narrower fore wings. In this genus will also come *coccinea* Hy. Edw. as North American.

Of the described species, *pomponia* Druce is *Eubaphe ostenta* Hy. Edw.; *splendida* Druce is green and can hardly belong to this genus. The others separate as follows. I have marked with an asterisk those examined by me.

1. Thorax, including patagia, black 2
   Patagia red or orange, at least at base 6
   Thorax, including patagia, red .... ***coccinea** *Hy. Edw.*
2. Primaries black along costal edge 3
   Primaries red along costal edge 5
3. Secondaries black except along costa 4
   Secondaries red with black border .... ***sanguineola** *Bdv.*
4. Costal edging of primaries broad .... ***erythrophora** *Feld.*
   Costal edging of primaries narrow .... **æqualis** *Walk.*
5. Outer border even .... **phrada** *Druce.*
   Outer border twice dentate .... ***flammans** *Dyar.*
   Outer border sinuately widened below .... ***sinuata** *Hy. Edw.*
6. Costal margin of primaries red 7
   Costal margin black at base .... **ira** *Druce.*
7. Secondaries black or mostly so 8
   Secondaries orange on basal half .... **pamphylia** *Druce.*
8. Primaries black except red costal line .... **rubromarginata** *Druce.*
   Costal half of wing red .... **xylophila** *Druce.*
   Primaries red, outer margin broadly black .... **pertunda** *Druce.*

NYCTEOLIDÆ.

Arctiidæ, *Nycteolinæ*, HAMPSON, Moths of India II, 128.
Noctuidæ, *Sarrothripinæ*, HAMPSON, Moths of India II, 365.
Cymbidæ, KIRBY, Cat. Lep. Het. I, 279.
Nycteolidæ, SMITH, List. Lep. 23.
Pseudoipsidæ, GROTE, Syst. Lep. Hild.
Nycteolæ, HUBNER, Tentamen.
Pseudoipes, HUBNER, Tentamen.

I see no sufficient distinction between Hampson's Nycteolinæ and Sarrothripinæ. The primary distinction founded on vein 8 of secondaries is negatived by some of his Sarrothripinæ, and the structure of the groups seems otherwise the same. The males have the bar-shaped retinaculum in both. The green and gray moths differ superficially, but the larvæ and cocoons are the same and are not Arctian. They are excluded from the Lithosians by the presence of ocelli. Family type *Nycteola revayana* Scop.

Nycteola proteella, *Walsh.*

1864, WALSH, Proc. Ent. Soc. Phil. III, 609, note (as Tortricid).
1867, WALSH, Proc. Ent. Soc. Phil. VI, 272, note.

Similar to *revayana*, but smaller and without the prominent angles at base of costa of fore wings. Gray, shaded with brown. Basal line curved, t.a. line straight, black, narrow; t.p. line wavy, strongly arcuate outward opposite cell; s.t. line undulate, shaded. The wing is nearly uniformly grayish with the lines faint, or heavily shaded with blackish and brown between the lines and more distinctly marked; very variable. Expanse, 14–17 mm.

Three examples from Walsh collection, U. S. Nat. Mus.

NOCTUIDÆ.

Cydosia *Westwood.*

New synonyms of this genus are *Penthetria* Hy. Edw. and *Tantura* Kirby. *C. majuscula*, the type of the genus, belongs to *Cydosia*. Neumoegen and Dyar placed it in the Lithosiidæ, but ocelli are distinctly present, as I have proved in fresh material. We could not examine the type freely, so failed to discover them.

The other species of *Penthetria*, namely *parvula*, from Florida, is a Tineid forming a curious pedunculate, lace-work cocoon. It is at present without reference to any genus.

Synopsis of forms of Cydosia.

Primaries with three golden brown bands.
 Many white spots on wing and thorax ....**nobilitella** *Cr.*
 Without white spots....................................**aurivitta** *G. R.*
Primaries without any markings..........................**majuscula** *Hy. Edw.*

Euclidia diagonalis, sp. nov.

Pattern of markings as in *E. intercalcaris* Grt., but the pale mark that arises near the anal angle is directed to the outer third of the cell instead of joining the pale reniform as in the allied species. Other markings similar but rather more drawn out longitudinally. A black streak runs through the cell, obscuring the punctiform orbicular. The white t. p. line is rather diffuse and shaded, straight, joining the oblique mark below. Expanse, 44 mm.

One ♀, Mesino Valley, New Mexico (Wheeler Survey, through A. S. Packard). Type No. 3844, U. S. Nat. Mus.

Apatela minella, sp. nov.

Closely allied to *A. fragilis* Guen. but uniformly shaded with dark gray. Head, thorax and fore wings blackish gray, the lines as in *fragilis*, the centers of t. a. and t. p. lines whitish and rather contrasting. Ordinary marks outlined in black, the basal dash indicated. Abdomen dark gray; secondaries scarcely darker than in *fragilis.*

One ♀. Type No. 3843, U. S. Nat. Mus.

The specimen is without locality label, but probably from Rocky Mountain region.

This may be a western form of *fragilis*.

NOLIDÆ.

Following Dr. Chapman's views on the phlyogeny of this group, I place them as a distinct family at the bottom of the Bombyces or between the Bombyces and Tineides. The larval characters correspond with this

position. Hampson makes them a subfamily of Arctiidæ and Meyrick includes them in the Arctiadæ, with which no fault is to be found if their different origin be kept in mind.

The following is a revision of our species, following Meyrick for genera.

Synopsis of Genera.

Primaries 10-veined, ♂ antennæ ciliate .... **Rœselia**
Primaries 11-veined, ♂ antennæ slenderly pectinate .... **Nola**
Primaries 12-veined .... **Meganola**

Rœselia *Hübn.*

Argyrophyes Grt. falls as a synonym on Meyrick's definition; also *Lebena* Walk.

Synopsis of Species.

1. Primaries gray 2
   Primaries in part white 3
2. Three costal dots, on basal, t. a. and median lines .... **triquetrana** *Fitch.*
   Two costal dots, on basal and t. a. lines .... **minna** *Butl.*
3. Wing shaded, grayish on costa and anal angle .... **sorghiella** *Riley.*
   Wing with marks contrasted, in part black 4
4. Basal white space cut off from costa .... **menalopa** *Zell.*
   Basal white space reaching costa, at least narrowly 5
5. Median band broad .... **pustulata** *Walk.*
   Median band defined only on outer half .... **cilicoides** *Grt.*

The type of *Nolaphana triquetrana* Fitch is in the Nat. Museum, and is *trinotata* Walk. = *sexmaculata* Grt. *Nola hyemalis* Stretch = *N. minna* Butl.

Nola Leach.

Synopsis of Species.

1. T.p. line outwardly arcuate opposite cell 2
   T.p. line nearly straight, not bent 4
2. Wing lines usually heavy as compared with costal spots 3
   Wing lines slight, costal spots heavy .... **phylla** *Dyar.*
3. Larger, markings blurred on a dark ashen ground .... **fuscula** *Grt.*
   Medium, markings somewhat contrasted on a whitish ground .. **minuscula** *Zell.*
   Smaller, the markings usually slender, the ground more ashen ..... **ovilla** *Grt.*
4. Basal dash on primaries less distinct than outer costal dot ...... **involuta** *Dyar.*
   Basal dash strong .... **exposita** *Dyar.*

Nola involuta, sp. nov.

|| *N. minuscula* Dyar, Psyche, VI, 248 (1892).

Fore wing dusky gray; t. a., t. p. and s. t. lines oblique, parallel, fine, finely dentate or dotted, nearly straight, the s.-t. faintest, but waved and bordered outwardly by a pale shade. On costa at base a brown dash; a brown tuft of scales on

t. a. line below costa, surrounded more or less by a diffuse cloud. Hind wing whitish, gray on the margin. Expanse, 18 mm.

Two ♂ ♂, Los Angeles, Cal. (Koebele, Coquillett), ♀ Santa Barbara, Cal. (Dyar). Type No. 3779, U. S. Nat. Mus.

Nola exposita, sp. nov.

‖*N. hyemalis* Dyar, Psyche VI, 110 (1891).

Fore wing pale gray, thinly scaled; t. a., t. p. and s. t. lines oblique, parallel, fine, finely dentate, nearly straight; lines obscure, especially the s.t On costa at base a brown dash; a brown tuft of scales on t. a. line below costa; a slight brown shade between t. a. and t. p. lines, especially on internal margin. Secondaries whitish, translucent. Expanse, 16 mm.

One ♂ Phœnix, Arizona (Dyar). Type No. 3780, U. S. Nat. Mus.

Close to *involuta*, but the larval habit is different.

Nola phylla, sp. nov.

Thorax and primaries bright silver gray. Lines as in *minuscula*, but very slender, minutely dentate. Three raised whitish dots in the cell, above which two distinct brown-bla k marks on costa, one at base, the other at end of cell. Secondaries and abdomen dark gray. Expanse, 17 mm.

Two ♀ ♀, Long Island, N. Y. (Dyar), Washington, D. C. (Koebele); also several other specimens. Type No. 3781, U. S. Nat. Mus.

The larva lives on the oak, but is different from *ovilla* and has different habits.

Meganola, gen. nov.

Primaries 12-veined, median 4-handed, 7–10 stalked, 7 given off before 10. Secondaries 7-veined, median 2-branched, vein 4 absent, 5 given off a little below middle of cross vein, 6–7 stalked, 8 joining subcostal for about one-third the length of cell. Hind tibiæ with two pairs of spurs, legs long, slender. Palpi about three times as long as head, broad, flattened, thickly scaled, obliquely descending. No ocelli. Primaries with three raised tufts of scales.

Meganola conspicua, sp. nov.

Thorax and fore wings dark gray. T.a. line just visible, arcuate, dentate; t p. line rather distinct, blackish, bent inward below median vein and obsolete on costa, finely blunt-dentate, free or closely paralleled inwardly by the median line which, when present, is irregularly dentate and bent towards base on costa; subterminal line obscure, inwardly waved, faintly bordered with whitish outwardly. A row of fine terminal white points with black scales inwardly. On costa at base a brown dash and a few brown scales also on the raised patches in middle and at end of cell. Secondaries grayish, pale at base. Expanse, 26 mm.

Three ♀ ♀, Texas; Colorado; Fort Grant, Arizona (H. G. Hubbard). Type No. 3789, U. S. Nat. Mus.

LACOSOMIDÆ.

Lacosoma arizonicum, sp. nov.

♂ fore wing slightly incised at anal angle and roundedly produced at vein 3, the apex rounded, not falcate; hind wing rounded, somewhat sharply angled at anal angle, and slightly excised between the veins. Body flesh color, shaded with rosy pink on head and pectus: antennæ yellowish with long pectinations. Wings pale brown, the basal half shaded with rosy pink, sparsely irrorate with brown. An obscure discal dot on both wings, black, overlaid with white, and a narrow, very slightly flexuous outer common brown line. Expanse, 29 mm.

One ♂. Chiricahua Mts., Arizona (H. G. Hubbard). Type No. 3789, U. S. Nat. Mus.

PYROMORPHIDÆ.

Acoloithus rectarius, sp. nov.

Entirely black, the collar concolorous. Fore wings slightly bluish, hind wings greenish. Expanse, 13 mm.

One example, Chiricahua Mts., Arizona (H. G. Hubbard). Type No. 3788, U. S. Nat. Mus.

Possibly not distinct from *Harrisina mexicana* Schaus, which I have not seen.

NOTES AND DESCRIPTIONS OF OSCINIDÆ.

BY D. W. COQUILLETT, Washington, D. C.

The insects comprising this family belong to the group of acalyptrate Diptera in which the auxiliary vein is imperfect or wanting, and the crossvein, which usually separates the discal from the second basal cell, is wanting, as is also the anal cell. The legs are short and rather robust. The only other family possessing these characters is the Ephydridæ, but in these the head is usually much broader than high, the aristæ of the antennæ are sometimes long pectinate on the upper side, the sides of the face are usually provided with bristles and the oral opening is often excessively large, none of which characters occur in the Oscinidæ.

In studying up the extensive series of specimens contained in the collection of the National Museum several new forms were met with, and it was found necessary to make a few corrections and additions to the genera given in Osten Sacken's catalogue. A large series of specimens of *Opetiophora straminea*, the type species of this genus, collected in Texas by Mr. E. A. Schwarz, shows that this genus is a synonym of

Hippelates. *Elachiptera* is the older name for *Crassiseta*, as *Mosillus* is of *Gymnopa*. The last named genus is not mentioned in Williston's recent manual. One European genus, *Eurina*, is now for the first time reported from this country, and a new genus, *Ceratobarys*, is erected for the *Hippelates eulophus* of Loew. The genus *Sigalœssa* of Loew, although placed by its author in the Asteidæ, and by Dr. Williston in the Drosophilidæ, may with propriety be admitted into the present family, from which it does not differ in any more important character than the shortened second longitudinal vein.

The genus *Elliponeura* is unknown to the writer in nature; all of the other genera reported from this country are represented in the National Museum collection.

Table of Genera.

1. Costal vein terminating at the tip of the third vein 2
   Costal vein continued to the fourth vein 6
2. Hind crossvein present 3
   Hind crossvein wanting .... **Elliponeura.**
3. Posterior femora not thickened 4
   Posterior femora unusually thick .... **Meromyza.**
4. Front projecting in front of the eyes at least two-thirds the length of their horizontal diameter 5
   Front not projecting more than one-half of the diameter of the eyes..**Chlorops.**
5. Third joint of antennæ at least twice as long as wide .... **Ectecephala.**
   . Third joint only slightly longer than wide .... **Eurina.**
6. Hind tibiæ each bearing a stout curved spur at tip of inner side............ 7
   Hind tibiæ destitute of such spurs.......................... 8
7. Antennal arista unusually broad .... **Ceratobarys.**
   Antennal arista slender .... **Hippelates.**
8. Tip of second vein less than the length of the hind crossvein beyond the first. **Sigalœssa.**
   Tip of second vein several times the length of the hind crossvein beyond the first.......................... 9
9. Arista of antennæ not broadened 10
   Arista unusually broadened .... **Elachiptera.**
10. Last section of fourth vein three or more times as long as the penultimate section.......................... 11
    Last section less than twice as long as the penultimate section ...... **Mosillus.**
11. Antennal arista bare or pubescent 12
    Antennal arista short plumose .... **Gaurax.**
12. Epistoma noticeably produced forward.......................... **Siphonella.**
    Epistoma not produced forward .... **Oscinis.**

Descriptions of New Species.

Eurina exilis, sp. nov.

Head yellow, the frontal triangle, antennæ, thickened base of the arista, the clypeus and occiput, except the sides and lower part of the latter, black; frontal

triangle polished, toward the sides striated, its lower end broad, rounded, reaching lower end of the front, sides of the latter bare; third joint of antennæ subquadrate, only slightly longer than broad. Thorax black, the sides and pleura yellow, the latter marked with four black spots, mesonotum coarsely punctured, scutellum yellow, convex. Abdomen black, the sides and venter yellow. Coxæ, femora and tibiæ reddish yellow, the middle of the hind tibiæ and all tarsi black. Halteres yellow. Wings grayish hyaline, third and fourth veins strongly diverging apically, hind crossvein twice its length from the small. Length, 4 to 5 mm.

Fourteen specimens, Beverly, Mass., June 4 and 20 (Edward Burgess), and Colorado (Carl F. Baker and H. K. Morrison). Type No. 3798, U. S. Nat. Museum.

Chlorops aristalis, sp. nov.

Head yellow, the front triangle, third joint of antennæ, clypeus and occiput except the sides and lower part black, arista white, the thickened basal part yellow; frontal triangle polished, the sides converging to below the middle of the front, then as a narrow line extending to the lower edge of the front, sides of the latter bearing short, black, bristly hairs; third joint of antennæ one and one-half times as long as broad, concave above and convex below; palpi unusually large, projecting nearly one-third of their length beyond the anterior oral margin. Thorax yellow, the mesonotum subshining, marked with five nearly contiguous black vittæ, the pleura marked with three blackish spots; scutellum yellow, convex. Abdomen dark brown, the sides and venter yellow. Coxæ, femora and tibiæ yellow, the tarsi brownish. Halteres yellow. Wings hyaline, hind crossvein one and two thirds times its length from the small. Length, 3 to 4 mm.

Three specimens. North Carolina and southern Georgia. Collected by H. K. Morrison. Type No. 3799, U. S. Nat. Museum.

Chlorops scabra, sp. nov.

Head yellow, the frontal triangle, second antennal joint and narrow upper edge of the third, the clypeus and occiput except the sides and lower part, black, arista brown, the thickened base black; frontal triangle polished, its sides converging to below middle of front, then nearly parallel, extending to lower end of front, sides of the latter bearing short black bristly hairs; third joint of antennæ orbicular, slightly shorter than wide. Thorax black, the sides and pleura yellow, one or two spots on the pleura, and the sternum largely black; mesonotum subshining, coarsely punctured; scutellum yellow, convex. Abdomen dark brown, the sides and venter yellow. Legs reddish yellow, a broad black band near middle of each hind tibia, apices of tarsi brown. Halteres yellow. Wings hyaline, hind crossvein over twice its length from the small. Length, 3 to 4 mm.

Two specimens. Oswego, N. Y. Collected July 17, 1896, by Professor Sheldon. Type No. 3800, U. S. Nat. Museum.

Chlorops rubida, sp. nov.

Head yellow, an ocellar dot and narrow upper edge of the third antennal joint, black; frontal triangle polished, punctured, each puncture bearing a short hair, a me-

dian, longitudinal carina on lower half of the triangle sides of triangle converging to lower end of front, pointed at the apex, sides of front bearing short black bristly hairs; third joint of antennæ orbicular, slightly longer than wide. Thorax yellow, five dorsal vittae and two spots on the pleura, reddish yellow; scutellum light yellow, flattened. Abdomen black, the ends, sides and venter yellow. Legs reddish yellow. Halteres light yellow. Wings hyaline, the hind crossvein slightly more than its length from the small. Length, 3 mm.

Two specimens. Colorado (H. K. Morrison), and Placer Co., Cal., in August (A. Koebele). Type No. 3801, U. S. Nat. Museum.

Chlorops graminea, sp. nov.

Head yellow, an ocellar spot, one on lower part of the triangle, the third antennal joint, thickened base of arista and two vittæ on the occiput, black, sides of triangle partly or wholly brown, terminal portion of arista white; frontal triangle opaque, punctured, bare, the sides converging to lower end of front, the apex broadly rounded, sides of front bare; third joint of antennæ orbicular, slightly shorter than wide. Thorax yellow, opaque, five dorsal vittæ and three or four spots on the pleura, black· scutellum convex, yellow, toward the sides brown. Abdomen black, the narrow hind margin and sides of each segment, and middle of venter, yellow. Legs reddish yellow, apices of femora, both ends of the tibiæ, and bases of the tarsi, light yellow, Halteres yellow. Wings hyaline, hind crossvein slightly more than its length from the small. Length, 3 mm.

Two specimens, Lancaster, Cal. Bred by A. Koebele. Type No. 3802, U. S. Nat. Museum.

Chlorops pullipes, sp. nov.

Head yellow, the frontal triangle, antennæ including the arista, the clypeus, palpi and occiput except the sides and lower part, brown or black; frontal triangle polished, the sides converging to lower end of front, sides of front bare; third antennal joint subquadrate, slightly longer than wide. Thorax polished, the dorsum black, sometimes marked with two yellow vittæ, pleura yellow, marked with four black spots; scutellum yellow, flattened. Abdomen black, hind margins of the fourth (usually) and fifth segments yellow. Legs brown or black, the trochanters, apices of femora, both ends of tibiæ, and bases of tarsi, yellow. Halteres yellow. Wings hyaline, hind crossvein slightly more than its length from the small. Length, 2 to 4 mm.

Sixteen specimens. Santa Fé, N. Mex. (T. D. A. Cockerell, in July and August), and Cañon City, Colo. (H. F. Wickham); other specimens from Colorado were collected by C. F. Baker and H. K. Morrison. Type No. 3803, U. S. Nat. Museum.

Chlorops assimilis *Macq.* An examination of the type of *Siphonella obesa* Fitch proves that it is a synonym of the above mentioned species. *Chlorops trivialis* Loew and *C. bistriata* Walker belong in the same category.

Chlorops prolifica *O. S.* A study of co-types of this species received from Dr. J. A. Lintner, shows it to be a synonmy of *C. variceps* Loew.

Gaurax anchora *Loew.* This species has been re-described by Dr. Williston under the name of *Elachiptera dispar* in Forbush and Fernald's report on the Gypsy Moth, page 390.

Gaurax montanus, sp. nov.

Head black, the lower part of the front, antennæ, except the arista, face, cheeks, proboscis and palpi, yellow; frontal triangle polished, the sides convex, the lower end not reaching below lowest fourth of the front, sides of front opaque velvety; third joint of antennæ reniform, one and one-half times as broad as long, arista densely short plumose. Thorax polished black, a large yellow spot above the middle coxæ; scutellum semicircular, yellow, the extreme base brown. Abdomen black, the base yellow. Legs, including the coxæ, light yellow. Knob of halteres black, the stem yellow. Wings hyaline. Length, 2 mm.

Two specimens. Mt. Washington (Mrs. A. T. Slosson) and White Mts., N. H. (H. K. Morrison). Type No. 3804, U. S. Nat. Museum.

Hippelates capax, sp. nov.

Head black, the lower part of the front, the face, cheeks and palpi, yellow; frontal triangle subshining, the sides convex, the lower end not reaching below the lowest third of the front, sides of front except the lower part opaque velvety, each bearing a row of short bristles; third joint of antennæ circular, arista pubescent; vibrissæ rather large. Thorax, scutellum and abdomen black, subshining, the venter basally yellowish. Legs dark brown, bases of femora and of tibiæ, yellow. Knob of halteres bright yellow. Wings hyaline. Length, 3 mm.

Northern Illinois. A female specimen collected October 27, 1895, by Dr. W. A. Nason. Type No. 3805, U. S. Nat. Museum.

Hippelates bicolor, sp. nov.

Head black, lower part of the front, antennæ, except the extreme apex, and the arista, face, cheeks and palpi, yellow; frontal triangle polished, the sides concave, the apex reaching lower end of front, bristles on sides of front very short, vibrissæ wanting; third joint of antennæ reniform, one and one-half times as broad as long. Thorax and scutellum polished black, the latter semicircular, wider than long. Abdomen yellow, sometimes marked with a dorsal row of black spots and a lateral black vitta. Legs and halteres yellow. Wings hyaline. Length, 2 mm.

Lake Worth, Fla. Two specimens collected by Mrs. A. T. Slosson. Type No. 3806, U. S. Nat. Museum.

Siphonella inquilina, sp. nov.

Head black, the lower part of the front, antennæ, face, cheeks and palpi, yellow; frontal triangle polished, the sides convex, the apex not reaching below the lowest fourth of the front; third joint of antennæ orbicular, slightly wider than long; palpi projecting one third of its length beyond the oral margin. Thorax

black, polished, in front of the scutellum bearing numerous black, bristly hairs; scutellum black, subtriangular, along the sides bearing numerous black, bristly hairs and at the apex with a pair of bristles which are pressed together toward their tips. Abdomen black, the base yellow. Coxæ, femora and tibiæ black, the trochanters and tarsi yellow. Halteres yellow. Wings hyaline. Length, 2 mm.

Thirty-two specimens. Virginia; and St. Louis and Kirkwood, Mo. Type No. 3807, U. S. Nat. Museum.

Oscinis virgata, sp. nov.

Head yellow, an ocellar dot, which sometimes extends over the entire frontal triangle, the occiput except the lower edge, the antennæ including the arista, the clypeus and apex of proboscis, black; frontal triangle polished, reaching only slightly below the middle of the front, the latter bearing numerous short, black bristles; third joint of antennæ suborbicular, slightly wider than long. Thorax subshining, yellow, the mesonotum marked with three black vittæ, a brown spot beneath the humeri and another beneath the wing; metanotum in the middle black; scutellum yellow, semicircular. Abdomen black, the venter yellow. Coxæ, femora and tibiæ yellow, outer side of front femora, and the front and hind tibia, tinged with brown; tarsi brown. Halteres yellow. Wings hyaline. Length, 3 mm. Colorado.

A specimen of each sex collected by Carl F. Baker. Type No. 3808, U. S. Nat. Museum.

Oscinis pectoralis, sp. nov.

Head yellow, the frontal triangle, occiput except the lower edge, and the antennæ including the arista, black; frontal triangle polished, reaching only slightly below the middle of the front, the latter bearing black bristly hairs; third joint of antennæ nearly circular, slightly wider than long. Mesonotum subshining grayish black, the sides and pleura reddish yellow, a brown spot beneath the humerus and another near middle of pleura; scutellum grayish black, semicircular; metanotum black. Abdomen black, the base and venter yellow. Coxæ, femora and tibiæ yellow, the tarsi brown. Wings hyaline. Length, 3 mm.

Franconia, N. H. A female specimen collected by Mrs. A. T. Slosson. Type No. 3809, U. S. Nat. Museum.

Sigalœssa flaveola, sp. nov.

Yellow, dorsum of thorax and of abdomen reddish yellow, the antennal arista and anterior oral margin black, a vitta on middle of occiput, a spot on front end of thorax, one above each humerus, a vitta on upper part of pleura and two spots on the lower part, brown; knob of halteres brown. Frontal triangle very small, scarcely exceeding the ocelli; third joint of antennæ orbicular, as long as wide. Wings hyaline, third and fourth wings strongly converging toward their tips, apex of second vein only slightly beyond the hind crossvein. Length, 1.5 to 2 mm.

Eight specimens. Franconia, N. H., Biscayne Bay, Fla. (Mrs. A. T. Slosson), and Washington, D. C. The specimens from the latter locality were collected on windows by the writer during May and July. Type No. 3810, U. S Nat. Museum.

DIPTERA FROM THE LOWER RIO GRANDE OR TAMAULIPAN FAUNA OF TEXAS—II.*

By C. H. TYLER TOWNSEND.

TABANIDÆ.

Tabanus atratus *F.*

Two ♂ ♂. April 16, and July 11. Brownsville, Texas.

The eyes are slightly pubescent. First posterior cell completely closed, very short petiolate. Length, 20 to 22 mm.

SYRPHIDÆ.

Eupeodes volucris *O. S.*

One ♀. May 2. Brownsville, Texas. Taken on foliage.

Length, 7 mm. Has ground color of abdomen brown, instead of black. This record extends the range of this species very considerably It is a characteristic species of the Plains, belonging distinctively to the *Upper Sonoran* subregion, and is one of those species which indicate the extension of the dilute *Upper Sonoran* to the Lower Rio Grande region. There is a certain element of *Upper Sonoran* present in the *Tamaulipan* fauna; and it is interesting to reflect that the dilute *Upper Sonoran* reaches to, and actually meets and mixes with the dilute *Neotropical* here on the Lower Rio Grande.

Baccha tropicalis *Towns.*

This species was described in Section I. It is most nearly allied to *B. notata* Loew of Cuba, a specimen of which from Florida has recently been identified by Mr. W. D. Hunter (with Dr. Williston's assistance). The Florida specimen, while stated to be a ♂ (Can. Ent. April, 1896, p. 97), possesses the peculiarities of wing coloration and abdominal markings distinctive of the ♀ of *tropicalis*. If it be a ♂, it is certainly a most aberrant one, judging from the usual sexual characters in this *Neotropical* group of *Baccha*.

NOTE.—While referring here to Mr. Hunter's papers, I wish to point out a few errors that he has made. In the Can. Ent. for April, 1896, p. 96, he states that up to that time there had been recorded only one specimen of *Baccha tarchetius* Walker, besides the type in the British Museum; and that that specimen was from New Jersey, collected by Mr. Keen, and is now in the National Museum. If he will refer to the Trans. Am. Ent. Soc. for March, 1895, p. 38, he will find

* Section I of this paper appeared in JOURN. N. Y. ENT. SOC. 1897.

that I recorded the species there from the District of Columbia, in a ♂ which I collected August 19. On page 101 of the same paper, Mr. Hunter says that, with the exception of Kansas records, *Spilomyia quadrifasciata* Say had not been recorded "outside of some of the extreme eastern States." I have recorded it from Michigan, in my paper above referred to. The fact that, throughout his paper, he repeatedly quotes Snow's records of species from Colorado and New Mexico, and entirely ignores my previous records of the same species of Colorado, New Mexico and Arizona, indicates that my paper was not seen by him. The drawing of broad statements as to distribution, without consulting the literature bearing on the subject gives rise to wrong impressions and can not be too strongly condemned; especially when it is remembered that my paper was a long and important contribution, on Syrphidæ particularly as well as other diptera, and appeared fully a year before, and in such a prominent medium as the Transactions of the American Entomological Society!

Volucella tamaulipana, sp. nov.

♂ ♀. Length, 5½ to 8½ mm., both sexes ranging through these sizes.

The ♀ in life is easily distinguished by having a lighter or more yellowish abdomen and scutellum than ♂. This is not by any means apparent in dried specimens. Front and face light yellow, face much produced downward to a blunt point; face and front white-pilose, vertex with black hair, cheeks with heavy shining black or brown stripes; facial stripe much less distinct, fuscous, brown at oval margin. Face very gently concave above the slight tubercle. Frontal vitta moderately broad, shining brown, lighter anteriorly. Frontal triangle yellow, tinged with fuscous along middle, hairs somewhat brownish. Antennæ about half as long as face, reddish-yellow; third joint subequilateral, a little bulged on edges of basal portion, and slightly narrowed on apical portion; arista hardly as long as antennæ, thinly long hairy above, and more thickly short hairy below. Thorax greenish-black, thickly clothed with short yellow hair, with a patch of black hair on posterior central portion of disk next the yellow prescutellar spot, whole of scutellum and larger or smaller prescutellar spot bright yellow, the wide lateral margins of thorax same except a fuscous space immediately above base of wings. A yellow spot on pleuræ directly below humeri, and a fuscous pale area in front of wing bases. Hair of scutellum bright yellow on anterior half or less, abruptly black on posterior half. Some longer weak bristles or hairs on edge of scutellum. Metanotum shining black, with an arcuate line of yellow next scutellum, and a fuscous area between. Disk of scutellum, viewed from above, appears broadly fuscous. Abdomen of a general yellowish brown; first segment blackish in middle, and black on narrow hind border; second segment wholly light yellow, except the sinuate hind margin blackish or brown, or with a median line of the brownish separating the elongate lateral yellow markings. Third segment with the same yellow markings quite distinct on anterior half of segment in some specimens, more or less distinctly divided by a median vitta,

in o hers very indistinct. When distinct these spots are usually evenly rounded on whole hinder border, and often reach to but little short of hind margin of segment. Fourth segment usually yellow on anterior lateral portion, often indistinct in dried specimens. Pubescence of fourth segment wholly white; of third white on front margin, very narrowly on median line but covering about half the length of segment on sides; pubescence of second white on about anterior half, somewhat irregularly following the yellow markings. Rest of pubescence of abdomen black. Pubescence of venter white, except near apex. Legs yellowish-brown, the knees yellowish, the tarsi clear brownish-yellow except last two joints (and sometimes tip of next) black. Second vein strongly sinuous near extremity. Wings hyaline, narrowly tinged with yellow along whole costa; less than the oblique apical third yellowish fuscous, with brown cloud on section of second vein at extremity of marginal cell, and a subhyaline space before it. A lighter space in end of first posterior cell. Heavy clouds on anterior crossvein, the crossveins at tip of second basal cell, and the origin of third vein. Brown cloud of stigma connected with that of anterior crossvein by a fuscous patch. Clouds of origin of third vein and tip of second basal cell are also connected by fuscous. Fuscous of tip narrowly and irregularly extended along inner margin of wing. The proximal boundary of the apical fuscous of the wing extends approximately from the end of the dilute stigma obliquely across to the end of second posterior cell.

Eleven ♀s, and twenty-four ♂s, as follows: All the ♀s June 24, except one June 28: all the ♂s June 24, except two June 25, one June 28, and one July 3, near Brownsville, Texas. All on flowers of *Lippia lanceolata* Michx., except two ♂s (June 25) which were hovering in air under shade of a large tree in woods. Others were seen hovering in this manner and poised in the air, in company with them. *In copula* June 24.

This species belongs to the group of *V. pusilla*, *satur*, etc. The apical fuscous of the wing has the same inner boundary shown in the figure of *pusilla* given by Williston (Synopsis Syrph. pl. 6, fig. 3). It is one of the short, stout species, with the abdomen subround, and wider than the thorax.

CONOPIDÆ.

Zadion albonotatum *Towns.*

The species was described in Section I. It is on the order of *Z. splendens* Jaeun., being practically, so far as effect goes, a melanistic and intensified color form of that species. It is, however, a perfectly good species, being quite distinct in its emphatic coloring.

NOTES ON SIPHONAPTERA, WITH DESCRIPTIONS OF FOUR NEW SPECIES.

BY C. F. BAKER.

Early in the course of my studies on the Siphonaptera I wrote Dr. Berg in Buenos Ayres, relative to the *Pulex grossiventrix* of Weyenberg which I had referred to *Sarcopsylla*. He very kindly sent me specimens of both male and female. These show some remarkable characters which justify the foundation of not only a new genus but a new family. I would here again call attention to the fact that we have yet no record of any fleas from bats in this country. The bat species are among the most interesting. I hope collectors having the opportunity will certainly secure specimens from any of our bats.

Family MEGAPSYLLIDÆ, fam. nov.

Body very large in the pregnant female, but the abdomen does not lose the normal texture or structure, the sutures remaining distinct, although much connective membrane is exposed between the plates. Antennæ normal. Eyes very large, in a rather small head. Mouth parts very stout, the labial palpi six or seven jointed (impossible to say which without dissection). Fourth tarsal joint very small, more or less connate with fifth, causing the tarsi to appear four-jointed. Last tarsal joint and claws greatly enlarged, the spines on the former inclining to somewhat foliaceous.

Megapsylla, gen. nov.

Head evenly rounded above in female, uneven and unituberculate in front in the male. Prothorax in the female with five or seven remote, short, stout, dark brown teeth; in the male unarmed. Fore tibiæ very small and short, but swollen. Maxillæ small, extending only to one-half of second joint of maxillary palpi.

Megapsylla grossiventris (*Weyenb.*).

1879, WEYENBERG, Boletin de la Acad. Nat. de Ciencias Repub. Argent. III, p. 188. (*Pulex grossiventris.*)

1895, BAKER, Can. Ent. XXVII, p. 3. (*Sarcopsylla grossiventris.*)

Length of ♂ 2.5–3.5, of ♀ 4 mm. to often 6.5 mm. when pregnant. Head and thorax, with legs, reddish to dark brown, abdominal plates dark smoky. Edges of antennal groove very minutely and thickly spinose. Sparingly bristled, but the bristles stout; the spines on the legs heavy, those on the fore tibiæ becoming very thick and tooth-like, and those on the fifth tarsal joint more or less flattened. Claws very large and recurved to the length of the fifth tarsal joint. Dorsal segments each with a single row of long bristles, six on a side. Upper claspers of male very large, naked, twice as long as broad, sides subparallel, tips obliquely cut off downward and backward.

Lives on the Armadillo (*Dasypus minutus*) in the Argentine Republic (Weyenberg and Berg.)

Pulex longispinus *Wagner*, Horæ. Soc. Ent. Ross. XXIII, 1889, p. 355.

Pulex lamellifer *Wagner*, ibid. XXIX, 1895, p. 504.

The descriptions of these two species did not come to my hands until after the publication of the Preliminary Studies. They both belong in my Division I of the genus. The former name was also unfortunately used by me. To the species described under this name by me I will now give the name *divisus*. An examination of further material may show it to be a *Typhlopsylla*.

Pulex multispinosus, sp. nov.

Male. Length, 3 mm. Head flat above, strongly rounded in front, face nearly vertical. Eye rather small but distinct, and near lower edge of head. Antennal groove extending obliquely through center of head to near upper margin; near the lower edge of head, with three very long and stout spines and three smaller in front and three long and stout ones behind. Bristles on second antennal joint as long as third joint. Labial palpi about equalling fore coxæ in length. Pro-, meso, and metanotums of nearly equal length, their discs with numerous small bristles; the pronotum provided with a "comb" of about forty teeth. Dorsal segments, each with one row of medium-sized bristles, twelve on a side, and two rows of minute bristles; ventral segments with a single row each, of four or five on a side. Tarsal spines, all small and weak, especially those on fore tarsi. In fore tarsi joints 2 and 5 are of equal length, a little longer than 1 and about equalling 3 and 4 together. In middle tarsi joints 2 and 5 are of equal length and about three-fourths of 1 which equals 3 and 4 together. In hind tarsi 1 equals 2 and 3 together, 2 equals 3 and 4 together, while 5 is scarcely half of 1. The decrease in length and width of joints in hind tarsi is very marked. Upper claspers very short and broad, trapezoidal in shape and unarmed.

Described from one male collected at Raleigh, N. C., by Messrs. H. H. and C. S. Brimley. The host is the Rabbit (*Lepus sylvaticus*.) This species belongs to my Division II, but is widely distinct from any described species. It has a greater number of teeth in the pronotal comb than any described flea excepting *Hystrichopsylla obtusiceps*.

Pulex gillettei *Baker*.

Prof. A. P. Morse has taken this species on the Screech Owl (*Megascops asio*) at Wellesley, Mass. The habits of the birds of prey make them at least temporary hosts for several species of fleas usually found elsewhere.

Pulex howardii *Baker*.

This flea is proving to be one of our most common and widely distributed species, both geographically and as to hosts. Mr. D. B. Young

has collected it at Newport, Herkimer Co., N. Y., on the Wood-chuck (*Arctomys monax*) and the Flying Squirrel (*Sciuropterus volucella*). Mr. Hubbard has taken it from a nest of the Silvery Mouse (*Cereus giganteus*) at Tucson, Ariz., and in debris of the Colorado River at Yuma, Ariz.

Pulex brunneri *Baker.*

Collected by Professor J. M. Aldrich at Moscow, Idaho, on the Spermophile (*Spermophilus columbianus*).

Belonging to a group of my Division II, which is composed of essentially American species. This group includes *hirsutus*, *coloradensis*, *bruneri*, *montanus* and *divisus*, and is distinguished by having one or both of the apical spines on the second joint of hind tarsi greatly elongated and exceeding in length joints 3 and 4 together.

Pulex arizonensis, sp. nov.

Male. Length, 2 mm. Head evenly rounded from occiput to mouth. A few bristles below, before and behind antennal groove. Bristles on apex of second antennal joint few but long. Eyes normal. Labial palpi somewhat exceeding fore coxæ. Pronotal comb of eighteen spines. Dorsal segments with two rows of bristles each, the principal row of six to seven bristles on a side. Fore and middle tarsi very weakly spined, hind tarsi with spines long and slender. In fore tarsi joints 1 and 3 are of equal length and a little shorter than 2, while 5 is as long as 1 and 2 together. In middle tarsi joints 1, 2 and 5 are subequal in length and as long as 3 and 4 together. In hind tarsi joint 5 equals 3 and 4 together, and is somewhat shorter than 2, while 1 equals 2 and 3 together; the bristles on the apex of joint 1 are about as long or shorter than joint 2. Upper claspers unarmed, little more than twice longer than wide, sides subparallel, bent below, apex rounded.

Described from a male taken by Mr. Hubbard at Tucson, Ariz., in a nest of Silvery Mouse.

Typhlopsylla pectiniceps *Wagner.* Horæ Soc. Ent. Ross, XXIII, 1889, p. 347.

Typhlopsylla bidentatiformis *Wagner.* Ibid., p. 351.

These are two other species previously also overlooked by me. The former is widely distinct from any other *Typhlopsylla* by reason of having combs of fourteen teeth each on either side of the head. The latter is quite near the *unipectinata* of Taschenberg.

Typhlopsylla assimilis *Tschb.* (var. ?).

Three females, nearer this species than any other, were taken on the Screech Owl (*Megascops asio*) at Wellesley, Mass., by Professor A. P. Morse. This occurrence is to be considered accidental. These

specimens cannot at present be definitely referred to this species without the males.

Typhlopsylla nudata, sp. nov.

Female. Length, 2 mm. This species is well distinguished by the almost entire absence of bristles on the body, coxæ and femora. The labial palpi about equal, the maxillary palpi somewhat exceed, the fore coxæ in length. Head otherwise normal, no vestige of eyes. Spines of tibiæ few and rather weak, spines on fore and middle tarsi very weak, almost entirely absent on the former; on hind tarsi long and slender, those on apex of first joint shorter than joint 2, but one of those on apex of joint 2 is much longer than joints 3 and 4 together, as in *Pulex bruneri* and allies. Middle and hind femora apparently deeply emarginate behind, before the apex, with an acute tooth before the emargination, a character not before noted in any American flea (Skuse mentions it for his *Stephanocircus*). In fore tarsi joints 1, 2, and 3 are subequal in length and little longer than 4, while 5 equals 1 and 2 together. In middle tarsi joint 5 equals 3 and 4 together and is a little longer than 1, the first four joints decreasing in length in this order, 1, 2, 3, 4. In hind tarsi joint 5 equals 3 and 4 together and 1 equals 3, 4, and 5 together, while 2 is somewhat longer than 5.

Described from two females taken by Mr. Hubbard from inner nest of *Neotoma albigula*, at Tucson, Ariz. This is the most interesting species of the genus yet found in North America. When the final disrupting of *Typhlopsylla* comes this will fall in a genus by itself.

Typhlopsylla charlottensis, sp. nov.

Female. Length, 1.75 mm. Head with two oblique rows of spines, the lowest much the stronger. Bristles on apex of second antennal joint short. Labial palpi nearly equalling fore coxæ. Pronotal comb of fourteen stout teeth. Dorsal segments with two rows of bristles, the principal row of five to seven long stout bristles on either side; ventral segments with three to four on a side. Fore coxæ strongly bristled. Spines of fore and middle tarsi very weak, of hind tarsi strong. In fore tarsi joints 1 and 2 are equal in length, 5 equals 3 and 4 together, and 4 is one-half of 1. In middle tarsi 1 equals 2 and 3 together or 4 and 5 together, while 2 equals 5. In hind tarsi spines all short, joint 2 is three-fourths of 1, equals 3 and 4 together and is one-fourth longer than 5.

Described from two females taken in a mouse nest at Massett, Queen Charlotte Islands, by Rev. J. H. Keen. It is nearest to *americana*, from which, however, it is very distinct as described above.

NOTES ON LEPIDOPTERA.

BY W. J. HOLLAND, LL.D., F.Z.S., &c.

The species named *Lycæna fuliginosa* by Mr. W. H. Edwards and as such listed in his Catalogue of the Butterflies of North America, published as an Appendix to the First Volume of the Butterflies of North America, has been in the Catalogue annexed to Volume II transferred to the genus *Thecla.* This is a palpable error, as an examination of the types reveals. I called the attention of Dr. Skinner to this fact long ago, and recently upon the occasion of a short visit paid me by Mr. Beutenmuller, I likewise called his attention to it. The fact seems to be worthy of publication. Edwards was right in his original location of the species. The upper side is of a uniform grayish brown and the markings of the underside as well as the form of the wings are of a truly lycænine character.

Entomologists have been puzzled for many years past by their failure to discover anywhere within the limits of the United States specimens of the species named *Pamphila omaha* by Mr. W. H. Edwards. The original description, which appeared in the Proceedings of the Entomological Society of Philadelphia, Vol. II, p. 21, stated that the type came from "Pike's Peak" and was contained in the collection of Mr. Newman, of Philadelphia, the well known collector, of whom the writer cherishes pleasant memories. In a letter recently received from Mr. Edwards he tells me that the specimens were collected by Mr. William Wood. Wood, I am informed, was a taxidermist, who also traded in a small way in insects, and had a lot of miscellaneous stuff in his shop coming from all sorts of places. He was not at all careful, so I am told, and but little dependence could be placed upon his locality labels, which were as likely to be incorrect as correct.

After Mr. Edwards had written his original description of *P. omaha* he returned the types to their owner. If I am not mistaken they are contained at present in the collection of the American Entomological Society of Philadelphia. At all events, two specimens labelled *Pamphila omaha* Edwards, are to be found there, corresponding perfectly with the description given by Edwards. They are mounted on common pins, not insect pins.

In the Edwards Collection there is a single specimen of *Pamphila omaha*, marked "*P. omaha, = mingo, Edw., Kanawha Co., W. Va.*" Mr. Edward writes me that so far as he is able to recall the facts this specimen, which is the original type of his *Pamphila mingo*, was taken,

as the label states, in Kanawha County. He tells me that having returned the types of *P. omaha*, he fell inadvertently into the error of redescribing the species three years afterwards under the new name.

In my studies of the Hesperiidæ I have been led to amass an exceedingly large collection of the Hesperiidæ of the world, and the other day Dr. Barnes, who was with me spending a little time in the examination of the Edwards Collection, called my attention to the obvious identity of *P. omaha* with the East Indian *Telicota mæsoides* Butler, of which I possess a large series of specimens. I had not noted the fact before, but, when my attention was called to it, the positive identity of the two things became at once manifest.

I strongly suspect that *Pamphila omaha* Edwards is not a native of this country. If we had only to do with the types originally acquired by Mr. Newman from William Wood I should have no hesitation whatever in saying that we are dealing with an error brought about by a mistaken locality-label. The assertion of Mr. Edwards that the type of *P. mingo* was taken in Kanawha County is the great obstacle to such a conclusion. Still it is possible that Mr. Edwards was mistaken also.

Elwes in his recent Revision of the Oriental Hesperiidæ, published in the Transactions of the Zoological Society of London, Vol. XIV, p. 254, gives the synonymy of the species. I reproduce it here, intercalating the additional synonyms of American origin:

Telicota dara Kollar.

Hesperia dara KOLLAR, Hugel's Kaschmir. Vol. IV, p. 455 (1848).

Hesperia omaha W. H. EDWARDS, Proc. Ent. Soc. Phil. Vol. II, p. 21 (1863).

Pamphila mæsa MOORE, P. Z. S., 1865, p. 509, Pl. XXV, fig. 9.

Hesperia mingo W. H. EDWARDS, Proc. Ent. Soc. Phil. Vol. VI, p. 207 (1866).

Pamphila flava MURRAY, Ent. Mo. Mag. XII, p. 4 (1875).

Pamphila nitida MABILLE, Pet. Nouv. II, p. 114 (1877).

Pamphila taxilus MABILLE, Ann. Soc. Ent. Belg. XXI, p. 38 (1878).

Carterocephalus omaha STRECKER, Butt. and Moths of N. A. p. 175 (1878).

Pamphila trachala MABILLE, Pet. Nouv. II, p. 237 (1878).

Pamphila mæsoides BUTLER, Trans. Linn. Soc. Lond. Ser. 2, Zool. Vol. I, p. 554 (1879).

Padraona mæsoides MOORE, Lep. Ceylon, I, p. 171, Pl. LXXI, figs. 5, 5a (1881)

Carterocephalus omaha EDWARDS, Butt, N. A. Appendix (1884).

Telicota mæsoides DISTANT, Rhop. Malay. p. 383, Pl. XXXIV, fig. 24 (1886).

Padraona pseudomæsa MOORE, Lep. Ceylon, I, p. 170 (1881).

Padraona dara WATSON, Hesp. Ind. p. 57 (1891).

Padraona dara LEECH, Butt. China etc. p. 596, pl. XL, figs 13, 14, vars. (1891).

Pamphila hetærus MABILLE, Compt. Rend. Soc. Ent. Belg. III, no. 31, p. 72 (1883).

Pamphila hetærus STAUDINGER, Iris, II, p. 145 (1889).

Padraona hetærus SEMPER, Schmett. Philipp. p. 303, Pl. XLIX, fig. 15, ♀ (1892).

Whether all of the several forms thus merged under *Telicota dara* Kollar, are positively identical may perhaps be questioned a little, but of the identity of *T. omaha*, with the form described as *P. mæsoides* by Butler there is not a shadow of doubt.

Mr. Elwes, in his revision of the Hesperiidæ of the Oriental Region referred to in the foregoing paragraph, describes as a new species a *Telicota* to which he gives the name of *simplex* (Cf. p. 253, Pl. XIX, Fig. 15, ♂). This is the same species which I described in the Proceedings of the Boston Society of Natural History, Vol. XXV, p. 79, Pl. IV, fig. 4, under the name *Telicota subrubra*. I do not much wonder that from the wretched figure I gave, Elwes was unable to make out the species, and I am thankful to him for having given so good a figure. Of course, his name sinks as a synonym. Had he noted my description and asked for information as he did in reference to some other species, I might have helped him to avoid the error. His work is a splendid contribution to our knowledge of the subject, and minor errors of this sort are likely to occur in the case of the most careful student.

Much has been written concerning *Limenitis floridensis* Strecker, and *Limenitis eros* W. H. Edwards. The latter author insists upon the distinctness of his species from that named by Strecker. I cannot agree with him. With the type of *L. eros* before me, and after having carefully examined the insect named *L. floridensis* by Strecker, I am sure of the identity of the two. Strecker's name has priority.

What is *Zeuzera canadensis* Herrich-Schaeffer? Under this name the distinguished lepidopterist of Ratisbon named and figured a species of *Zeuzera*, which, he informs us, came from "Quebeck" (*sic*). From the time of the publication of his plate to this present hour no such insect has turned up on American soil. I recently purchased, while in London, a set of a *Zeuzera* from Natal, which is undoubtedly the insect figured by Cramer as *Noctua asylas* (Pap. Exot., Pl. 137, fig. C). Is not this species of Cramer the same as the one figured by Herrich-Schaeffer? It looks to me as if possibly *Z. canadensis* might be an African form, and that we are dealing in this case again with a mistaken locality-label. *Quien sabe?* *

* I was tempted to drop a line to Dr. A. G. Butler of the British Museum requesting him to confer with Sir George F. Hampson and let me know whether my

REPLY TO DR. DYAR'S NOTE.

BY A. RADCLIFFE GROTE.

In reply to Dr. Dyar's note, this Journal, V, 66, I would state that, having no preparations of the larvæ, I may have failed to follow entirely Dr. Dyar's remarks and any misstatement of them has arisen in this way. I would suggest that Dr. Dyar figure them in outline as I have done with the neuration. I consider the "stinging spines" as adaptive, secondary characters, unfit for classificatory purposes of this nature and not decisive of phylogeny. With regard to the anal tubercle, Dr. Dyar regards it as primary—of this I cannot judge, but naturally accept this dicta. And this is the only main point. I regard the pattern of neuration as "primary" and that it unites, in one phylogenetic group, *Hemileuca* and *Saturnia* and *Automeris* and *Aglia*. As to other characters, the structure of the female antennæ appears to fall in very well with my classification as also the specializations of the pupal envelop. This whole case seems to converge into: anal tubercles *vs.* pattern of neuration. It is a test case and should be settled before we go any further. It appears to me a physiological impossibility that *Aglia* should be derived from the Saturnian branch or that *Hemileuca* should be derived from the Aglian stem. From his point of view Dr. Dyar thinks the reverse and hence a settlement of the controversy, which should not be suffered to run into side issues, is very desirable.

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surmise as to the identity of *Z. canadensis*, H. S. with *Z. asylas* of Cramer met with their approval. I have just received the following reply contained in a letter written January 1st, 1898.

"As desired, we have looked into the identity of *Zeuzera asylas* Cram. and *Z. canadensis* H. Sch., and have come to the conclusion that you are quite correct in the belief that both figures represent the same African species. We have nothing approaching it from any temperate country and all the species of this type appear to be inhabitants of the tropical parts of the old world."

I accept it then as established that *Zeuzera canadensis* H. Sch. is a synonym for *Z. asylas* Cram., and the species should be stricken from our lists of North American species. Herrich-Schaefer's locality "*Quebeck*" was evidently an error.

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STUDIES IN THE PTINIDÆ, CIOIDÆ AND SPHINDIDÆ OF AMERICA.

By Thos. L. Casey.

The term "America," in the above title, is employed to designate that portion of the American continent embraced within the boundaries of the United States. There should be no more ambiguity in designating the United States of America as America simply, than in calling the United States of Brazil, or the United States of Colombia by the last word of their respective titles. It may perhaps be considered egotistical for us to appropriate to ourselves the name characterizing the continents of the western hemisphere, but as we have no other title to distinguish us among the numerous aggregates of united states which compose these continents, there is no reasonable motive for avoiding the apparent conceit.

PTINIDÆ.

Ptilinini.

The insects of this tribe form an appropriate introduction to the Bostrichinæ, for they are evidently a connective bond with the Anobiini. Our species have not been studied for many years. We have two genera as follows:—

Antennæ strongly flabellate in the male, serrate in the female............**Ptilinus**
Antennæ slender and feebly serrate in the male, shorter and somewhat stouter but rather more strongly serrate in the female..................**Euceratocerus**

The eyes are rather larger and more convex in *Euceratocerus* than in *Ptilinus*, but are much smaller in the female than in the male. Selecting the apparent males by this character I have been unable to observe any pectination of the male antenna in *pleuralis*, though it may exist in *horni*, of which I have not seen the male.

Ptilinus *Geoff.*

The long slender pubescent appendages of the male antenna are not an extreme development of the usual serriform structure, but project from the base of the joints, the joints themselves being slender and sometimes cylindrical. In the female, however, the joints are prolonged outwardly and in an obliquely anterior direction, forming a truly and quite strongly serriform antenna. The males differ from the females not only in the structure of the antennæ but in the much denser sculpture of the entire body, and frequently to a very great degree in the form of the prothorax. In the following table of the species included within my cabinet, all the discriminating characters refer to the female, except in the case of *flavipennis*, of which the only known example is a male:—

Color uniform throughout or very nearly, the elytra not paler.................. 2
Color blackish, the elytra flavate.. 8
2—Prothorax sinuate at the sides subapically, the apex more or less prominent in a rounded or feebly sinuate lobe................... 3
Prothorax arcuately oblique subapically, the apex angulate and slightly prominent 6
Prothorax broadly and evenly arcuate at apex, feebly sinuate in the middle...... 7
3—Elytra distinctly punctured only toward the base, the punctures nearly obselete toward tip; thoracic lobe feebly and evenly crenulate. California..**basalis** *Lec.*
Elytra distinctly punctured throughout...................................... 4
4—Thoracic lobe narrowly rounded and with a few closely approximate serrules at tip. Pennsylvania to Indiana ....**ruficornis** *Say*
Thoracic lobe broadly rounded, with a feeble cuspiform emargination and minutely and evenly serrulate throughout...5
5—Scutellum elongate, finely and densely rugose; epipleuræ gradually wider at base. *Female.*—Body rather stout, cylindrical, dark piceo-castaneous in color throughout, the legs scarcely, the antennæ much, paler; lustre rather dull, the pubescence very short and dense on the elytra. Head convex, minutely and densely granulate, the transverse frontal impression distinct. Prothorax distinctly wider than long, widest at about the middle, narrowed slightly to the base, rapidly and just visibly sinuate to the apical lobe; surface minutely and densely granulose toward base, more coarsely, sparsely and irregularly so toward apex, the median line finely impressed. Elytra three-fourths longer than wide, equal in width to the prothorax, minutely and densely subgranulose in texture, with the punctures rather strong, sparse and distinct, feebler toward tip, where they are more distinctly intermingled with small granules and the ground lustre is more shining. Length 4.0 mm.; width 1.5 mm. Nebraska..... ....**lobatus,** sp. nov.
Scutellum quadrate, coarsely rugose; epipleuræ rapidly wider at base. *Male.*—Cylindrical, opaque, black, the legs scarcely paler, the antennæ pale rufous, the rami infuscate; pubescence extremely minute and not very conspicuous. Head convex, dull, minutely subgranulose, the eyes convex, separated on the front by about four times their own width. Prothorax about a third wider than long, broadly, evenly arcuate at base, gradually narrowed and arcuate at the sides from

the broadly rounded basal angles to the apex, the latter much narrower than the base and evenly and more strongly arcuate; surface densely granulato-rugose throughout, the median line very fine and subobsolete. Elytra three-fifths longer than wide, rather wider than the prothorax and much more than twice as long, very densely granulato-rugose and opaque, the punctures distinct throughout, with about two impressed series along the lateral margin. *Female.*—A little larger and paler in color than the male, with more shining elytra, upon which there are more distinct traces on each of three or four feeble ridges. Prothorax larger, fully as wide as the elytra, rounded at the sides, widest just behind the middle, the surface more sparsely and decidedly granose toward tip. Elytra scarcely three-fifths longer than wide, twice as long as the prothorax. Length 3.0–3.5 mm.; width 1.1–1.2 mm. Indiana.................... **pruinosus**, sp. nov.

6—Elytral punctures only distinct near the base, where they are fine. *Female.*—Evenly cylindrical, piceous, the legs and antennæ paler; pubescence very short, even, extremely dense, yellowish in color and conspicuous on the elytra; lustre rather shining. Head evenly convex, minutely granulato-rugose, the epistomal impression small and rather feeble. Prothorax not quite as long as wide, the sides parallel and feebly arcuate; apex broadly and evenly ogival; surface minutely granulose, becoming nearly smooth at the sides toward base, the granules coarse and pronounced toward apex except laterally. Scutellum quadrate, feebly convex, dull. Elytra fully three-fourths longer than wide, about twice as long as the prothorax, smooth and alutaceous, without trace of impressed lines at any part. Abdomen rather convex, the second segment somewhat longer than the first. Length 2.8–4.0 mm.; width 0.9–1.4 mm. California (Sta. Cruz Mts.). **acuminatus**, sp. nov.

7—Elytra with fine, even and somewhat impressed striæ in both sexes. *Male.*—Cylindrical, blackish, the elytra generally a little paler; legs and antennæ pale, the flabellum infuscate; surface dull, the humeral callus more shining. Head short, inserted to the eyes which are well developed and strongly convex; surface but feebly convex, densely scabrous and opaque; antennal joints very short, the rami very long and slender. Prothorax a little shorter than wide, parallel and straight at the sides, broadly and evenly rounded in apical third or fourth, with a minute sinus at the middle; surface coarsely, densely and roughly granulato-scabrous throughout the width, becoming much more finely so and smoother toward base. Scutellum moderate, subquadrate. Elytra three-fourths longer than wide, a little more than twice as long as the prothorax and rather wider, densely dull and finely granulato-rugose, the second and fifth intervals uniting and rather convex near the declivity, the ninth also becoming broader and slightly convex behind. *Female.*—Rather shining and dark rufo-testaceous throughout, the prothorax similar in form but rather shorter and fully as wide as the elytra, with the rugulosities more distinct and isolated, nearly smooth toward base, the head more elongate, narrower and with the eyes small and distant from the prothorax; elytra rather flattened on the posterior declivity, with the intervals slightly uneven. Length 3.0–4.2 mm; width 0.9–1.4 mm. California (Sta. Cruz Mts.)...................................... **ramicornis**, sp. nov.

8—Elytra with rather strong punctures unevenly arranged throughout. *Male.*—Cylindrical, blackish and opaque, the elytra flavate and less dull; legs paler, the

antennæ pale flavate; pubescence short, fine and moderately distinct. Head rather short, inserted nearly to the eyes, which are well developed and very convex; surface moderately convex, dull and subscabrous; antennæ moderate in length, the rami unusually short and gradually thickened from their bases, the ramus of the fourth joint three times as long as the joint. Prothorax distinctly shorter than wide, the outline broadly parabolic from the base continuously around the apex, the sides becoming almost parallel near the base, which is broadly arcuate, finely margined toward the middle; surface densely granulato-scabrous, larger individual granules but slightly evident toward tip. Scutellum longer than wide, dull, obtuse at tip as usual. Elytra three-fourths longer than wide, twice as long at the prothorax and scarcely wider, the punctures equally visible throughout, rather large but sparse and with but the vaguest suggestion of lineal arrangement. Length 2.4 mm.; width 0.8 mm. California (Los Angeles Co.) .... **flavipennis**, sp. nov.

The female in this genus generally has a short acute transverse ridge near the apex of the last ventral segment, but in *ramicornis* the fifth segment is simple in that sex, having merely a very small and shallow impression at the apex. The male usually has the fifth ventral simple or slightly more convex at the apex, where it is broadly and evenly rounded.

Acuminatus is represented before me by seven females varying greatly in size, and the male is apparently rare; on the other hand *ramicornis* is represented by nine specimens, only two of which are females. *Thoracicus* Rand., is not known to me at present and is therefore omitted from the table.

Euceratocerus *Lec.*

The fifth ventral segment is generally impressed in the female of *Euceratocerus* and is rather shorter than in the male, where it is simple. The species are all elongate and subcylindrical, though rather less convex than in *Ptilinus*, the head minutely and densely granulose, the prothorax less minutely and very clearly and evenly granulate throughout the disk, but rather more densely at the summit of the more convex median parts near the base. The elytra have very fine, scarcely impressed striæ, which extend nearly to the apex in *horni*, and that species is well distinguished from any of the California representatives by the two basal impressions of the pronotum. The species are very much more closely allied among themselves than those of *Ptilinus*, and the male appears to be very rare in comparison with the female. The four species in my cabinet may be identified as follows from the female:—

Basal joint of the hind tarsi very much shorter than the entire remainder, the second joint relatively more elongate; pronotum impressed at each side near the basal margin; elytra more elongate; eyes separated by rather less than three times their own width. Texas .... **horni** *Lec.*

Basal joint but slightly shorter than the entire remainder, the second joint relatively much shorter; pronotum not impressed sublaterally at base................2

2—Pleural sulcus below the humeri deep and strongly marked; elytra twice as long as wide; eyes separated by evidently more than three times their own width. Body rather stout, the elytra subdilated near the tip, blackish-piceous above, the legs and antennæ dark rufous or rufo-piceous; surface feebly shining, the pubescence extremely short, pale, dense and conspicuous on the elytra. Head short, inserted to the eyes, dull, the epistomal impression well marked. Prothorax three-fifths wider than long, rounded at apex, the sides thence strongly diverging and feebly sinuate, becoming parallel and broadly rounded in basal half; basal angles rounded. Elytra twice as long as wide, more than three times as long as the prothorax and fully as wide, a little wider at apical third; humeral angles rounded. Length 3.7–4.5 mm.; width 1.3–1.7 mm. California (Sta. Cruz Mts.) ....**pleuralis**, sp. nov.

Pleural sulcus narrow and feeble... 3

3—Elytra fully twice as long as wide; eyes small, separated by fully four times their own width. Body very slender, nearly as in *pleuralis* but narrower, the elytra not distinctly wider behind and fully three and one-half times as long as the prothorax, the latter nearly similar in outline but still more transverse, the sides becoming parallel in less than basal half, with the median line similarly finely impressed anteriorly. Length 2.9 mm.; width 1.0 mm. California (locality not indicated) .... **macer**, sp. nov.

Elytra much shorter, three-fourths longer than wide; eyes more convex and better developed, separated by three times their own width. Body suboblong, moderately convex, dull, blackish, almost similar throughout to *pleuralis* but shorter, the prothorax relatively rather smaller and the elytra much shorter, not distinctly dilated subapically, and with the minute subgranuliform rugulosity still finer and the pubescence a little denser, the fine striæ distinct to the summit of the convex declivity. The hind tarsi are longer than in *pleuralis*. Length 3.4 mm.; width 1.25 mm. California (locality not indicated)..**saginatus**, sp. nov.

The descriptions are derived throughout from the female, the only male accessible to me being one of the four examples of *pleuralis*. This male is very much smaller and narrower than the female, with the eyes better developed and separated by slightly more than twice their own width; the prothorax is more transverse and almost semicircular in outline from the base around the apex, near which it is perhaps more correctly broadly parabolic; the last ventral segment is simple, rounded ta apex and not quite as long as the two preceding combined; the antennæ do not differ essentially in structure from those of the female, but are rather more slender.

BOSTRICHINI.

The genera of Bostrichini have not been considered in their mutual relationships for twenty years, when a review of them was published by Dr. Horn. I find it necessary to increase the genera recognized by

that author by five, the species hitherto placed in *Sinoxylon* being quite heterogeneous and in no single instance truly a member of that genus. *Sinoxylon dinoderoides*, *Amphicerus fortis* and *Dinoderus brevis* are also types of distinct genera. The genus proposed for the last named species is called *Patea* in the table. The genera known thus far may be thus distinguished:—

Tarsi long, with the last joint relatively shorter, the second joint usually elongate; claws and tibial spurs stouter, grooved beneath, the edges of the groove minutely crenulate. 2

Tarsi short, the four basal joints subequal among themselves and together nearly equal to the fifth; claws smaller and more slender, not at all crenulate within. . 9

2—Funicular joints of the antennæ very short and closely united, together never longer than the first joint of the club, the latter long, loose and strongly compressed 3

Funicular joints more elongate and less closely united, together generally much longer than the first joint of the club 6

3—Antennal club 3-jointed.. 4

Antennal club 4-jointed.. **Tetrapriocera**

4—Antennæ 10-jointed, the elytral declivity with well-marked spines or tubercles. . 5

Antennæ 9-jointed, the elytral declivity without spines or tubercles at the sides, or with very rudimentary tuberculiform irregularities, excavated near the suture, the latter with a spiniform elevation; antennal club moderate in development, its joints decreasing in width and only very feebly serriform ..... **Xylopertha**

5—Antennal club moderately developed, its first and second joints nearly similar in form; elytral declivity sexspinose.. **Xylobiops**

Antennal club greatly elongated, its first and second joints dissimilar in form, the former more or less outwardly produced at apex; elytral declivity quadrituberculose.. **Dendrobiella**

6—Joints of the antennal club strongly compressed and deeply bistriate from the apical margin; front simply tumid; hind angles of the prothorax rounded. **Amphicerus**

Joints of the antennal club strongly compressed but not striate, the two sensitive patches near the apices of the joints rounded and feebly marked; front lamellarly prominent behind the clypeus; hind angles of the prothorax not rounded. . **Apatides**

Joints of the antennal club but feebly compressed and generally quite convex, the first two more or less transverse, with the two sensitive patches rounded and subapical; front not transversely prominent.. 7

7—Tibiæ dentate externally; claws abruptly bent at base, not distinctly crenulate; size very large .... **Dinapate**

Tibiæ not dentate; claws evenly arcuate; size moderate or small.................. 8

8—Front margined at the sides; eyes well developed .... **Bostrichus**

Front not margined, convex; eyes small .... **Micrapate**

9—Antennæ with the two basal joints relatively smaller, the funicle well developed; club rather short, 3-jointed.

Antennæ 10-jointed; body elongate, the head exserted............. **Dinoderus**

Antennæ 11-jointed; body short and stout; head deeply inserted. .... **Patea**

In *Tetrapriocera* and *Patea* the antennæ are 11-jointed. In all the others they are 10-jointed, except in *Xylopertha* and in one species of *Bostrichus*, where they have but nine joints. *Tetrapriocera longicornis* (= *schwarzi* Horn) is the only known species of that genus. *Xylopertha* is confined, as might be expected, to the subsiberian fauna of the Pacific coast, where it is represented by *bidentata*, *declivis* and *suturalis*, hitherto placed in *Sinoxylon*, which genus has the two basal joints of the antennal club short and transverse. *Xylobiops* is proposed for the *Sinoxylon basillare*, *texanum*, *sextuberculatum* and *floridanum* of the present lists. *Dinapate wrighti*, the type and only known species of the genus, is the largest bostrichid known; it will probably soon become extinct by reason of the destruction of its food-plant for commercial purposes.

Dendrobiella, gen. nov.

This genus inhabits the warmer parts of the North American continent and also the West Indies; the species known to me may be identified by the following characters:—

Elytral punctures distinct throughout the disk, except at the sides, where they are obsolete, finer toward base, coarser posteriorly to the brink of the declivity, the latter smooth and impunctured as usual throughout the genus.

Larger species, 5.5–6 mm. in length, blackish in color........... **sericans** *Lec.*

Smaller species, 4 mm. in length, rufo-piceous in color..... **quadrispinosa** *Lec.*

Elytral punctures rather fine and sparse but distinct toward base, becoming wholly obsolete toward the declivity. *Male*.—Head well developed, the surface flattened, polished, nude and finely, sparsely punctulate, bituberculose at the base of the vertex; eyes moderate, very prominent; antennæ pale, longer than the width of the head, the first seven joints together scarcely longer than the first joint of the club, the tenth joint long and narrow. Prothorax wider than long, slightly narrowed anteriorly, broadly truncate at apex, the sides becoming parallel behind the middle; apical asperities moderately coarse and obtuse at the sides; disk polished, finely, subimbricately punctulate toward the middle in more than basal half. Elytra shining, the pubescence rather long, fine, decumbent, fulvous and conspicuous; apical truncature flat and shining, the tubercles moderate, the lower more obtuse. *Female*.—Smaller than the male but nearly similar, except that the head is smaller, more convex, less shining, feebly convex, punctured, pubescent and devoid of tubercles. Length 4.3–5.0 mm.; width 1.75–2.1 mm. Texas (Brownsville).............................. **pubescens**, sp. nov.

Elytral punctures wholly obsolete, being feebly traceable only very near the base. *Male*.—Head moderate, flattened, becoming concave behind the frontal margin, minutely, sparingly puberulent, slightly shining, finely and rather closely punctulate throughout; two small tubercles of the vertex on a transverse line through the posterior limits of the eyes; antennæ but little longer than the width of the head, nearly as in *pubescens*. Prothorax much wider than long, feebly narrowed in

apical half, very broadly truncate at apex, the apico-lateral serrules acute, about three in number; sculpture nearly as in *pubescens*, except that the disk is finely, sparsely punctulate toward base, without trace of imbricate sculpture. Elytra smooth, conspicuously pubescent; apical tubercles small and rather feeble. Length 5.0 mm.; width 2.0 mm. Island of Jamaica...... **sublævis**, sp. nov.

It is probable that *pubescens* is the species identified as *sericans* by Gorham in the "Biologia."

Amphicerus *Lec.*

This is a rather large and important genus among our bostrichids, not at all closely allied to *Apate* as is said to be the case by Mr. Gorham in the "Biologia," the two differing radically in the form of the antennal club among other characters. The species known to me are as follows:—

Elytra deeply margined at apex...2

Elytra not strongly margined at apex, smaller species, brown or testaceous in color, with the sculpture toward the base of the pronotum less broadly granulose and more nearly strigose...7

2—Elytra 4-tuberculate at the summit of the apical declivity, less distinctly so in the female; body generally black throughout...3

Elytra bituberculate at the summit of the apical declivity, rudimentarily so in the female; color dark brown, the elytra less coarsely punctate..................6

3—Pubescence of the elytra wanting or not distinguishable under low power......4

Pubescence of the elytra conspicuous but decumbent..........................5

4—Elytra of the female more elongate, distinctly more than twice as long as wide, with coarse and close-set punctures. Southern Texas to Honduras. **punctipennis** *Lec.*

Elytra of the female distinctly shorter, about twice as long as wide, with smaller and sparser punctures. *Female.*—Body cylindrical, black, polished and glabrous. Head two-thirds as wide as the prothorax, with the eyes rather large, very convex and prominent; vertex transversely tumid and pubescent; sculpture coarsely granulato-rugose; antennæ as long as the width of the head, dark rufo-piceous. Prothorax as long as wide, parallel and broadly arcuate at the sides, narrowed and serrate at the sides anteriorly, the apex sinuato-truncate, with the apical teeth small; surface coarsely asperato-granose anteriorly, smooth with flattened contiguous tubercles posteriorly. Elytra more than twice as long as the prothorax and a little wider, the punctures coarser and closer toward the sides and strongly and coarsely confluent on the apical declivity; tubercles rudimentary. Abdomen with whitish pubescence, minutely and densely punctulate, with coarse punctures interspersed. Length 12.0 mm; width 4.0 mm. Texas (Galveston).. **maritimus**, sp. nov.

5—*Female.*—Body very slender, cylindrical, shining, black with a feeble piceous tinge. Head three-fourths as wide as the prothorax, the eyes very convex and prominent; vertex moderately tumid, the surface granulato rugose with a smooth

median spot posteriorly; antennæ rather stout, not quite as long as the width of the head. Prothorax obviously shorter than wide, narrowed somewhat from very near the base, more rapidly and arcuately and with moderate serrules anteriorly, the apical sinuation narrow with the teeth small; surface coarsely asperato-tuberculate anteriorly, smoother in basal two thirds, the sculpture becoming coarsely subimbricate in the middle toward base, with the surface shining and the median line finely impressed. Elytra much more than twice as long as wide, nearly three times as long as the prothorax and just visibly wider, the punctures coarse and close-set, subserial in arrangement, coarse, contiguous and subconfluent on the declivity, the tubercles feeble, especially the inner. Abdomen finely punctulate, pubescent, the scattered larger punctures rather small. Legs quite slender. Length 9.0 mm.; width 2.5 mm. Kansas, Iowa and North Carolina. .... **gracilis**, sp. nov.

6—Pubescence distinct, decumbent. Sutural series rather impressed, the suture elevated on the declivity. Head rather small, the eyes moderate in size. Elytral punctures not serial in arrangement, but with traces of three fine raised lines. Indiana and Kansas .... **bicaudatus** *Say*.

7—Prothorax emarginate at apex, fully as long as wide and with the usual terminal teeth of the lateral series. *Male*.—Rather stout, cylindrical, shining, dark testaceous-brown in color; antennæ pale; surface virtually glabrous. Head moderate, nearly two-thirds as wide as the prothorax, broadly, almost evenly convex, with a large median impunctate area; transverse impression behind the clypeus deep and distinct; eyes small and but moderately prominent; antennæ fully as long as the width of the head. Prothorax fully as long as wide, the sides broadly arcuate, becoming parallel only very near the base, converging anteriorly where the serrules are prominent and close-set in less than apical half; apex narrowly sinuate. surface tuberculose anteriorly, becoming smooth and polished in basal half and almost sculptureless toward the sides but sparsely imbricato-strigose toward the middle. Elytra short, one-half longer than wide, equal in width to the prothorax, strongly but not very closely, confusedly punctate, more closely but scarcely coalescently behind, the declivity very steep, more convex at each side above but not tuberculate, the suture elevated. Abdomen finely, strongly and densely punctulate, the scattered coarser punctures not visible, the pubescence even, decumbent and rather dense; last segment shorter than any of the preceding. Hind tarsi very much longer than the tibiæ. Length 6.7 mm; width 2.2 mm. Texas (El Paso) .... **grandicollis**, sp. nov.

Prothorax truncate at tip, with the angles obtuse and rounded, without trace of processes 8

8—Larger species, the prothorax much wider than long and trapezoidal in form; *Female*.—Rather slender, cylindrical, shining, subglabrous, dark rufo-testaceous in color. Head well developed, nearly three-fourths as wide as the prothorax, the surface granose throughout, tumid posteriorly, the epistomal suture just beyond the middle of the length and impressed toward the middle, the epistoma large; eyes very large, convex and prominent; antennæ obviously shorter than the width of the head, with the club relatively very long, the five joints of the funicle together barely equal in length to its first joint. Prothorax much wider than long, the sides parallel and feebly arcuate nearly to the middle, then

strongly convergent to the truncate apex, the latter not visible from above but narrow and feebly sinuate; declivity coarsely asperate above, smoother near the apex, subserrate laterally, the teeth not extending to the apex; basal half rather dull in lustre and with short strigiform lines not densely placed. Elytra about twice as long as wide, between two and three times as long as the prothorax and rather wider, rather coarsely, deeply and irregularly but uniformly and quite densely punctate, very densely and perforately so behind, the declivity moderately steep, more convex at each side but not tuberculate, the suture elevated. Abdomen closely punctulate, the pubescence moderately abundant. Tarsi very long. Length 6.5–7.0 mm.; width 2.0–2.2 mm. Texas (El Paso).
brevicollis, sp. nov.

Small species, 4.5–5.5 mm. in length, the prothorax as broad as long. Body elongate, cylindrical, sparsely clothed with moderately long semi-erect hair; elytra coarsely and seriately punctate; under surface sparsely punctate. California (Fort Yuma) ....**teres** *Horn*

Grandicollis is described from what appears to be the male, but the eyes are very small when compared with those of *brevicollis*, of which the four homogeneous examples before me seem to be females; both of these species and probably *teres* also, which I have not seen, have the funicle of the antennæ much shorter than in the others; in *grandicollis* the five joints together are however quite distinctly longer than the first joint of the club; in *brevicollis* they are barely as long as the first joint but do not have the closely crowded structure observed in *Sinoxylon* and *Tetrapriocera*. In *brevicollis* there are a few erect hairs observable near the sides of the elytra especially behind, but otherwise the surface is glabrous and the punctures are only feebly subseriate in arrangement.

Apatides, gen. nov.

This genus is amply distinct from *Amphicerus* in the characters of the table. We have the following three species:—

Inner margin of the epipleuræ continuous and obliquely ascending at base to the humeral angles in the female; basal angles of the prothorax acute and prominent; head and abdomen finely punctate, the former slightly tumid or subcarinate along the middle toward the frontal margin. Lower California and California (Yuma)..**fortis** *Lec.*

Inner margin of the epipleuræ discontinuous at base in the female, basal angles of the prothorax not at all rounded but at the same time not distinctly prominent, the surface less impressed before the angles................................2

2—Vertex gradually ascending to the prominent frontal margin, finely and sparsely punctate, the abdomen minutely punctulate throughout; thoracic processes separated by rather more than a third of the total width. *Male*.—Head three-fifths as wide as the prothorax, the latter nearly as long as wide, with the

apical processes long and obliquely convergent; surface with the usual isolated tubercles toward base. Elytra twice as long as wide, just visibly wider than the prothorax, the apical declivity flattened, becoming alutaceous in lustre and almost impunctate toward the suture, which is elevated *Female.*—Similar to the male but larger, with the thoracic processes short and parallel, the elytra rather more than twice as long as wide and more distinctly wider than the prothorax, the apical declivity convex and coarsely perforato-punctate throughout, the suture moderately elevated. Length 13.0–15.5 mm.; width 4.3–5.1 mm. Texas (El Paso).................................**robustus**, sp. nov.

Vertex more tumid and convex, less finely and quite strongly punctured throughout; abdomen strongly though sparsely punctured toward base; thoracic processes more approximate, separated by but little more than a fourth of the total width. *Female.*—Head moderate in size, the eyes very convex and prominent as usual. Prothorax not quite as long as wide, nearly as in *robustus* but less devoid of sculpture toward the basal angles. Elytra not at all more than twice as long as wide, the apical declivity rather more convex at each side than in *robustus*, steeper and a little less coarsely punctured. Abdomen polished as usual, the punctures becoming finer and denser toward apex. Length 12.5 mm.; width 4.3 mm. Arizona (Locality not specified—Levette Cabinet.)

puncticeps, sp. nov.

The male of *fortis* has the apical processes more convergent and longer than the female, but there seems to be no modification of the elytral declivity near the suture. Individuals vary much in size as usual in the Bostrichinæ.

Bostrichus *Geoff.*

The genus *Bostrichus*, as represented in America, differs remarkably from *Amphicerus* in the structure of the antennal club, the joints being short, subglobose, and with the sensitive spaces small and circular; it also differs in having the basal angles of the prothorax acute and prominent, but in that respect resembles *Apatides*, from which it differs in turn in the structure of the antennal club and frontal parts of the head. The following table comprises all the species known to me at present: —

Prothorax narrowly and deeply sinuate at apex, with the limiting processes prominent and generally unciform; elytra each with two ridges more or less distinct or interrupted...2

Prothorax sinuato-truncate at apex, with the limiting angles acute and somewhat prominent; vestiture hair-like, decumbent and unevenly distributed; elytra without trace of ridges; species smaller and more slender.................5

2—Hind tarsi fully as long as the tibiæ; unciform processes of the prothorax more prominent. Atlantic regions..3

Hind tarsi shorter than the tibiæ; unciform processes shorter, not differing in form from the lateral serrules..4

3—Vestiture of the elytra squamiform; inner ridge strong and continuous to the apical declivity .... **bicornis** *Web.*

Vestiture more hair-like and still more unevenly disposed in clusters; inner ridge feeble and much interrupted, the outer almost obsolete .... **armiger** *Lec.*

4—Elytral vestiture long and hair-like, very sparse and almost evenly disposed; ridges fine, feeble and subobsolete .... **californicus** *Horn*

5—Antennæ 10-jointed as usual........ .... **truncaticollis** *Lec.*

Antennæ 9-jointed. Evenly cylindrical, black, the antennæ and tarsi paler; vestiture coarsely hair-like, fulvous in color, dense and conspicuous, somewhat uneven on the elytra but much less nucleated than in *truncaticollis*. Head moderate, opaque, pubescent, the eyes well developed; antennæ as long as the width of the head, the funicle 4-jointed. Prothorax nearly as long as wide, roughly tuberculose, pubescent, the basal angles acutely prominent; median line somewhat depressed. Elytra slightly wider than the prothorax, two and one-half times as long as wide, coarsely, densely, unevenly punctured and finely tuberculose. Legs rather short and slender, the hind tarsi longer than the tibiæ. Length 6.4 mm.; width 1.8 mm. New Jersey (Woodbury). **angustus**, sp. nov.

In the males the elytral apices are minutely spinulose throughout, but there is very little sexual difference otherwise, except that the male is generally smaller and with the elytra less elongate. It will probably prove necessary to generically separate the American species of *Bostrichus* from the European forms, when the family is monographed as a whole.

Micrapate, gen. nov.

This genus is founded upon the *Sinoxylon dinoderoides* of Horn, and its allied species, and I have ventured to include also the *S. simplex* of that author, although the size is so much greater that renewed observation would possibly disclose some divergencies of a generic nature. I should have been disposed to refer the specimens described above under the name *Amphicerus brevicollis* to *S. simplex*, were it not for the fact that the basal parts of the pronotum are said to be "densely punctate," which language it would be impossible to apply to *brevicollis*, where the sculpture of that part consists of short, isolated and longitudinal raised lines, as in the *Amphicerus teres* of Horn. It is a peculiarity of *Micrapate* that the basal parts of the pronotum are truly and simply punctate, and not in any way asperate, granose or tuberculose. Our species are as follows:—

Pronotum less densely or rather sparsely punctured toward base; size much smaller, never materially exceeding 4 mm. in length.............................2

Pronotum densely punctate toward base.......................................3

2—Surface "feebly shining;" suture moderately and evenly elevated on the apical declivity. Arizona and Texas (Brownsville) .... **dinoderoides** *Horn*

Surface strongly shining; sutural elevation on the declivity strong, its summit for a short distance at the middle of the declivity, still more elevated, dilated and canaliculate. *Female.*—Similar to *dinoderoides* but smaller, the epistomal suture more deeply impressed and more remote from the apical margin. Prothorax nearly as long as wide, similar to *dinoderoides* but still more sparsely punctate toward base. Elytra rather coarsely, strongly punctured and very densely so, the punctures rather sparser toward the suture except on the declivity, but not as sparse as in *dinoderoides*, the surface unevenly rugose by anteriorly oblique light. Under surface finely and densely punctulate, confluently so on the sterna. Length 3.4 mm.; width 1.15 mm. District of Columbia .....**cristicauda**, sp. nov.

3—Size larger, 6.5 mm. in length. Body piceous, the elytra brownish; head opaque, tuberculate, the maxillary palpi with the last two joints equal; prothorax wider than long; elytra not wider than the prothorax, very coarsely and closely punctate, the punctures of the declivity coarser and denser, the sutural region slightly elevated, especially in the apical declivity. Body beneath moderately densely punctate, sparsely pubescent. Texas (southwestern) ....**simplex** *Horn*

I have here regarded the specimens recently taken by Mr. Wickham in the extreme southern part of Texas, near Brownsville, as representing the true *dinoderoides*, but actual comparison will be necessary to decide, as these examples are certainly strongly shining.

Dinoderus *Steph.*

The rather numerous species of this genus may be outlined in the table which follows. *Punctatus* and *truncatus* are the only discordant elements after eliminating *brevis*, and they may have to be separated at some future time.

Apex of the elytra convex, the suture only very rarely somewhat prominent, the apical margin not concave or prominently margined; pubescence erect...... 2

Apex of the elytra more abruptly truncate, concave and prominently margined at tip; pubescence decumbent. 13

2—Pronotum with granuliform and separated tubercles toward base............ 3

Pronotum with flattened and generally subcontiguous tubercles toward base; side margins almost devoid of serrulation except at apex; body more cylindroconvex 8

3—Elytra polished or strongly shining....................................... 4

Elytra opaque; color dark brown or blackish-piceous......................... 5

4—Elytra with very close-set perforate punctures, larger than the width of the intervals, the latter tuberculose; color dark brown throughout. Michigan, Canada and Europe......................... ....**substriatus** *Payk.*

Elytra with less coarse and impressed punctures, not larger than the width of the intervals, the latter less elevated and more feebly but distinctly tuberculose; color black or blackish. Head moderate, exserted, with a polished constriction at base as usual; surface subopaque, granulose, the epistomal suture distinct; apex sinuate; eyes small, convex; antennæ stout, dark rufous, not as long as the

width of the head. Prothorax not quite as long as wide, the apex broadly arcuate, the sides becoming parallel and feebly arcuate near the base, serrate throughout, rather strongly at the rounded basal angles and still more coarsely around the apex; base broadly lobed; surface with small, strong and isolated granules throughout, intermingled anteriorly with some larger sparse asperities. Scutellum small. Elytra not quite twice as long as wide, more than twice as long as the prothorax and slightly wider; surface with series of moderately coarse punctures, confused near the suture and smaller and less seriate on the flanks; intervals asperate; apex evenly convex, with the punctures confused and asperate. Abdomen shining, sparsely punctulato-rugose and finely, sparsely pubescent. Length 4.0–4.8 mm; width 1.3–1.6 mm. California (Calaveras Co.), Colorado and Idaho (Cœur d'Alène)............................ **pacificus**, sp. nov.

Elytra with less coarse and more impressed punctures, nearly as in *pacificus* and not larger than the width of the intervals, the latter perfectly even, polished and devoid of tubercles or asperities throughout. Body deep black, the erect hairs of the elytra rather short. Head dull, sparsely pubescent, the epistoma broadly sinuate. Prothorax not quite as long as wide, arcuately swollen toward base, broadly rounded and asperato-tuberculose at apex; disk granose toward base. Elytra slightly wider than the prothorax, rather short, four-fifths longer than wide, the punctures seriate in arrangement, densely confused near the suture, more broadly toward base, small and irregular in arrangement toward the side margins, the apical declivity evenly convex and not at all granulose though more closely and unevenly punctate. Abdomen shining, sparsely punctulate. Length 2.7–3.7 mm.; width 0.8–1.2 mm. Wyoming (Laramie) and Arizona.

sobrinus, sp. nov.

5—Elytral granules strong and well defined, arranged in even single series along the intervals.............................. 6

Elytral granules subobsolete except on the declivity, the punctured series contiguous, with the intervening ridges narrow and alternately slightly stronger 7

6—Elytra roughly and densely punctate on the declivity, the tuberculose intervals equal throughout, finely and confusedly on the flanks. Head short and transverse, granose, the basal constriction exposed as usual; eyes small; antennæ short, the club paler; epistomal suture subobsolete. Prothorax slightly shorter than wide, nearly as in *pacificus*. Elytra not quite twice as long as wide, rather wider than the prothorax, the lustre dull, the sculpture coarse and rough, the punctures of the series large, deep and approximate but circular and well defined, except at the sides. Abdomen minutely, sparsely punctulate, feebly pubescent. Length 4.0 mm.; width 1.4 mm. New Mexico (Fort Wingate)... **asperulus**, sp. nov.

Elytra finely, evenly and strongly granose on the declivity; intervals separating the punctured series equal in elevation; punctures of the series coalescent and not well defined. Head short and transverse, finely granose, the labrum declivous, the eyes and antennæ moderate. Prothorax not quite as long as wide, broadly rounded and strongly asperate anteriorly, the sides feebly diverging to the rounded and asperate basal angles; disk with the granules equal, strong and isolated toward base. Elytra but little wider than the prothorax, scarcely twice as long as wide, densely sculptured in even series, except near the suture and

more broadly on the flanks, the elevations polished. Length 5.2 mm.; width 1.6 mm. Arizona (Seligman).. .. ..**amplus**, sp. nov.

Elytra rather sparsely and strongly granose on the declivity; intervals separating the punctured series alternating in prominence; punctures of the series subtransverse, subcoalescent and not well defined. North Carolina...**porcatus** *Lec.*

7—Punctures of the elytral series confluent, opaque and not well defined. Head transverse, opaque and granulose; eyes small; antennæ short, dark rufous, the club not paler. Prothorax nearly as in *pacificus*, the basal angles less rounded. Elytra about twice as long as wide, slightly wider than the prothorax and much more than twice as long; sculpture very dense, the surface densely opaque; erect hairs moderate in length, stiff and fulvous. Abdomen rather dull, finely, sparsely punctulate. Length 3.0–4.0 mm.; width 0.9–1.2 mm. Virginia (Norfolk).................... ....**opacus**, sp. nov.

8—Elytral punctures confused in arrangement, at least toward the sides and suture..9

Elytral punctures forming perfectly even series throughout the width, the intervals even.... 12

9—Apical declivity of the elytra granulose, the punctures more close-set throughout. 10

Apical declivity simply punctate.................................. 11

10—Elytral punctures distinctly asperate throughout. Body and legs blackish, the antennæ rufo-piceous; surface moderately shining. Head short, not very densely granose. Prothorax not quite as long as wide, the sides feebly convergent from near the broadly rounded basal angles, merging gradually into the broadly rounded and moderately serrulate apex; surface sparsely, rather strongly asperate anteriorly, more closely granulate toward base, the granules flattened, less dense laterally. Elytra about two-thirds longer than wide, twice as long as the prothorax and scarcely wider; punctures not very coarse, serial in arrangement, the intervals flat and even; apex evenly convex, strongly grano-tuberculose. Abdomen shining, sparsely punctulate. Length 3.7 mm.; width 1.2 mm. New Jersey........................ ....**hispidulus**, sp. nov.

Elytral punctures circular, not asperate on the disk and toward the suture, feebly granuliferous on the convex declivity; elytra polished, the intervals flat; serial arrangement of the punctures only observable along the middle of each elytron. South Carolina.......................... ....**densus** *Lec.*

Elytral punctures abnormal, not rounded but somewhat dilated at their posterior limits, serial in arrangement and well separated, more confused near the suture and broadly toward the sides, not granulose except posteriorly and on the declivity. Body evenly cylindrical, shining, dark piceous, the elytral vestiture sparse, stiff and erect. Head nearly smooth, constricted at base as usual. Prothorax nearly as long as wide, oval, asperulate anteriorly, the basal angles rounded; disk with the flattened and nearly contiguous tubercles toward base small. Elytra perfectly cylindrical, barely twice as long as the prothorax and perceptibly wider, not quite twice as long as wide, polished. Length 2.4 mm.; width 0.7 mm. Pennsylvania................. ....**parvulus**, sp. nov.

11—Dark rufo-piceous, the elytra blackish, highly polished with rather small and simple punctures, which are only feebly subserial in arrangement, becoming very small and feebler on the flanks and simple on the declivity. Indiana and South Carolina........................ ....**cribratus** *Lec.*

12—Body small, narrow, subglabrous, highly polished and pale rufo-testaceous throughout; apical margin of the prothorax rather crenulate than serrulate. Iowa (Keokuk). Cosmopolitan and introduced............. **pusillus** *Fabr.*

13—Antennæ with the second joint nearly as slender as the third, the funicle bristling with long coarse hairs anteriorly; ridge of the apical declivity short; head strongly, transversely tumid behind the epistoma. New York, Indiana and South Carolina.. **punctatus** *Say*

Antennæ with the second joint stout, the funicle not more setose in front; declivity more abrupt and flat, with the marginal ridge long. California.
truncatus *Horn*

I have not been able to compare *substriatus** of the table with European examples, and the identification is taken from the books; it is referred to the genus *Stephanopachys* by Heyden, Reitter and Weise, who separate also *pusillus* under the generic name *Rhizopertha* (*Rhyzopertha*). The differences seem to be scarcely generic in value. *Truncatus* of Horn, I have not seen.

CIOIDÆ.

The Cioidæ are intimately related to the Bostrichinæ, as shown by general organization, and particularly by the two small rounded sensitive areas near the apices of the joints of the antennal club, greatly developed in the genus *Plesiocis*; but, at the same time, they are closely allied also to some groups at present assigned to the Clavicornia, such as the Cryptophagidæ and Mycetophagidæ. In fact, the assemblages which are at present collectively known as the Clavicornia, are so heterogeneous among themselves as to indicate that they do not form a natural division of the Coleoptera at all, but are in many cases the extreme developments of various types of Serricornia or Adephaga, and the Heteromera belong near them in immediate succession. *Berginus* has a purely serricorn habitus, and yet has been placed with the Mycetophagidæ. I believe that the Cryptophagidæ and Mycetophagidæ should not be widely separated from Cioidæ and Sphindidæ, and I am in favor of removing them from the so-called Clavicornia and placing them in the Serricornia near Cioidæ. This would be far more natural than to remove the Cioidæ to the Clavicornia. The Cucujidæ, consisting of the subfamilies Passandrinæ, Colydiinæ, Monotominæ, Rhysodinæ, Lyctinæ, Silvaninæ, Brontinæ, Cucujinæ and Hemipeplinæ should also be removed from the Clavicornia and follow Cioidæ, Cryptophagidæ, etc., in the Serricornia. The Hemipeplinæ form a natural transition to the Heteromera.

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* *Dinoderus substriatus* is said by Mannerheim (Bull. Mosc., 1853, p. 233), to inhabit also the Kerai Peninsula, in Alaska.

The Cioidæ consist of two subfamilies, Cioinæ and Rhipidandrinæ, distinguished by clavate and compactly serrate antennæ respectively. The American genera of Cioinæ are as follows:—

Antennæ 10-jointed 2
Antennæ 9-jointed.................. 7
Antennæ 8-jointed; body glabrous....... 8
2—Prosternum well developed before the coxæ; lateral edges of the prothorax acute to the apex 3
Prosternum very short and transversely excavated before the coxæ; lateral edges of the prothorax becoming subobsolete at the apex 6
3—The prosternum simple or nearly so.......................................4
The prosternum tumid or carinate along the middle 5
4—Body setose or pubescent the vestiture erect and bristling, the anterior tibiæ finely produced and dentiform externally at apex, sometimes simple ....**Cis**
Body glabrous, the anterior tibiæ wholly unarmed at apex; elytral suture margined toward tip; body elongate, the head rather less deflexed than usual, the head and prothorax simple in the male, the latter with a deep rounded setigerous fovea at the centre of the first ventral segment....................**Orthocis**
5—Body glabrous or with very short decumbent pubescence or inclined setæ. **Xestocis**
6—Body very short, oblong-oval in form, with stiff erect pubescence as in *Cis*. **Brachycis**
7—Body stout, convex, coarsely cribrate and setose; anterior tibiæ strongly, obliquely produced and acute externally at apex....................**Plesiocis**
Body narrow, cylindrical, feebly sculptured and glabrous, the anterior tibiæ thickened and externally rounded and spinulose at apex.................**Ennearthron**
8—Anterior tibiæ swollen, rounded and spinulose externally at apex as in *Ennearthron*; head and prothorax strongly modified in the male............ **Ceracis**
Anterior tibiæ narrowly triangular, the external edge straight throughout and minutely spinulose; head and prothorax not modified in the male. . **Octotemnus**

The term glabrous, as used above, signifies the absence of distinct pubescence; with high power each puncture can be seen to bear a very small hair. Many of Mellié's species are still unknown to me, and the localities of some of them may be open to doubt; a few may possibly be synonyms, as, for example, *atripennis*, which may have been founded upon a damaged specimen of *fuscipes*. It is possible that the *Cis pumicatus* of Mellié may prove to be an *Octotemnus*. *Ceracis* is very closely allied to *Ennearthron*, and was indeed considered to be more properly a subgenus by Mellié. The figure of *C. sallei*, on plate 4 of the monograph, seems to have been taken from a specimen of *Ennearthron mellyi*.*

* I am indebted for several very interesting species of Cioidæ to my friend, P. Jerome Schmitt, of Westmoreland county, Pa., and Mr. Wickham has also contributed a number of interesting species in Bostrichinæ, Cioidæ and Sphindidæ.

Cis *Latr.*

Only those species represented before me are included in the following table:—

Elytra with shallow, variolate and nude punctures, intermingled with others smaller and deeper which bear the setæ..2
Elytra deeply punctured throughout, all the punctures bearing hairs or setæ......11
2—Body stout and convex, the elytra confusedly rugulose; maxillary palpi very stout; anterior tibiæ acute and feebly everted externally at tip; apical angles of the prothorax right and somewhat prominent, the apex prolonged and broadly rounded over the head; base not distinctly margined......................3
Body narrowly elongate-oval and more depressed, the surface less rugose but with the elytral series more distinct; maxillary palpi variable but generally less stout; antennal club smaller, with the two basal joints wider than long; apical angles of the prothorax obtuse, the apex broadly, evenly rounded over the basal parts of the head, the base finely margined; scutellum transversely oval.............8
3—Elytral bristles moderate in length, more or less distinctly serial in arrangement, the antennal club long and loose, with the two basal joints as long as wide; head and pronotum finely, evenly punctured, the elytral punctures fine, not very distinct and rather sparse; male sexual characters very feeble................4
Elytral bristles extremely short, distributed uniformly but without order; antennal club shorter, with the two basal joints wider than long; male characters pronounced.. 7
4—Third and fourth joints of the antennæ elongate and equal, each as long as the fifth and sixth together. Body stout, shining, castaneous in color, the head moderate, with the clypeal margin feebly reflexed and broadly subtruncate; eyes rather well developed; prothorax distinctly wider than long, the sides reflexed, feebly convergent and feebly, evenly arcuate from the obtuse basal angles to the apex; elytra one-half longer than wide, twice as long as the prothorax and just visibly wider. Length 2.4–2.8 mm.; width 1.05–1.25 mm. North Carolina (Asheville) .... **carolinæ**, sp. nov.
Third joint much longer than the fourth, the latter distinctly shorter than the fifth and sixth combined...5
5—Concave side margin of the pronotum not at all inwardly prolonged at base; body large, generally pale in color, shining; prothorax more than one-half wider than long, the basal angles very obtuse and rounded; sides slightly convergent and very feebly, evenly arcuate throughout; elytra barely one half longer than wide, nearly two and one-half times as long as the prothorax and slightly wider, the humeral callus small but pronounced. Length 2.8–3.0 mm.; width 1.1–1.3 mm. Montana (Missoula) ....**pallens**, sp. nov.
Concave margin more or less distinctly prolonged inwardly at base; color black or piceous-black, the size smaller...6
6—Male with the prothorax simple throughout. Atlantic regions, from Massachusetts to Iowa and Texas (Houston) ....**fuscipes** *Mell.*
Male with the prothorax broadly impressed at apex. Body moderately stout, strongly convex, blackish in color and shining, the elytral punctures generally stronger

than those of the pronotum, with the impressed lines distinct; head with the clypeal margin moderately reflexed and broadly sinuato-truncate in both sexes; prothorax two-fifths wider than long, the sides feebly convergent, rather more rounded near the base; elytra one-half longer than wide, fully twice as long as the prothorax and just visibly wider posteriorly. Length 1.8–2.75 mm.; width 0.8–1.2 mm. Pacific coast—Vancouver Island, Washington State (Tacoma) and California (Humboldt Co. and Alameda)............... **impressa**, sp. nov.

7—Body rather stout, strongly convex, oblong-suboval, shining, blackish in color throughout, the legs and antennæ dark rufous; vestiture very short and almost scale-like, erect as usual; head moderate, the eyes well developed, convex and prominent; prothorax one half to three-fifths wider than long, the sides rather widely reflexed, slightly convergent and broadly, evenly arcuate throughout, the basal angles very obtuse; surface finely, closely punctured but polished; elytra more than one-half longer than wide, nearly two and one-half times as long as the prothorax and very slightly wider, the humeral callus small; surface confusedly rugulose, finely punctate and with slightly evident longitudinal lines and short transverse rugæ. *Male*.—Head concave, the clypeal margin reflexed and broadly bidentate; prothorax impressed transversely at the apical margin, the latter moderately reflexed, with a small rounded sinuation at the middle. *Female*.—Head flat, the clypeal margin very slightly reflexed, broadly, feebly sinuato-truncate, the prothorax rounded and unmodified at apex. Length 2.2–2.5 mm.; width 0.9–1.1 mm. Rhode Island (Boston Neck)..**pistoria**, sp. nov.

8—Anterior tibiæ finely everted and acute externally at apex..................9

Anterior tibiæ simple at apex 10

9—Pronotum not impressed at the apical angles, the flanks deeper, the side margin feebly reflexed, more strongly about the basal angles. *Female*.—Body elongate-oval, moderately convex, piceous, the elytra black; legs and antennæ paler, rufous, shining, the bristles short and pale, moderately abundant, not arranged in definite series on the elytra though with feeble suggestion of such arrangement at certain parts; head moderate, the eyes small, the clypeal margin broadly arcuate; prothorax nearly as long as wide, circularly arcuate in apical third, the sides thence nearly straight and parallel to the basal angles, which are very obtuse; base arcuate; punctures rather fine, strong and close-se ; elytra three-fourths longer than wide, two and one-third times as long as the prothorax and scarcely wider; punctures fine, strong, close-set, the impressed lines distinct and with rather coarser irregular punctuation. Length 2.3 mm.; width 0.8 mm. Colorado (Salida)...... ....**striolata**, sp. nov.

Pronotum impressed at the apical angles, the side margins strongly, narrowly and equally reflexed throughout. *Female*.—Nearly similar to *striolata* but shorter, the prothorax fully one third wider than long, with the sides subparallel, evenly and feebly arcuate throughout, the apex broadly, evenly arcuate; punctures fine, strong and rather close-set; elytra two-thirds longer than wide, two and one-half times as long as the prothorax, the surface polished, with distinctly impressed lines of much coarser punctures, which are shallow, nude and variolate as usual, the bristles arranged more definitely in series. *Male*.—Smaller than the female and more slender, the clypeal margin rather strongly rounded near the eyes and remotely and feebly bituberculate at the middle; prothorax only slightly shorter

than wide, the sides feebly convergent and evenly and feebly arcuate from the base, the apex circularly rounded, the surface dull; elytra polished, nearly as in the female; first ventral segment foveate at the centre. Length 2.0–2.2 mm.; width 0.65–0.75 mm. Utah (southwestern)............. **fraterna**, sp nov.

10—Body more slender, picious black throughout. *Female.*—Narrowly elongate-oval, moderately convex, shining; legs and antennæ rufous; bristles short, pale as usual, arranged in almost regular series on the elytra; front feebly convex; eyes moderate in size; clypeus broadly arcuate, very short before the eyes; prothorax nearly one-third wider than long, the sides feebly convergent, evenly and feebly arcuate from base to the rather pronounced apical angles, which are not rounded, the apex circularly arcuate, the punctures fine but deep, moderately close; elytra two-thirds longer than wide, nearly two and one-half times as long as the prothorax and somewhat wider, the humeral callus minute; series well impressed, almost regular but not much more coarsely punctate, the intervals sparsely punctulate. Length 1.9 mm; width 0.7 mm. California (Lake Tahoe) **macilenta**, sp. nov.

Body stouter and more cylindric, bicolored, the head and prothorax rufous, the elytra black. *Female.*—Oblong-subcylindric, moderately convex, slightly dull in lustre; bristles short, feebly subserial on the elytra; head feebly convex, the clypeus broadly arcuato-truncate, oblique at the sides to the eyes, which are small; prothorax fully one-third wider than long, nearly as in *macilenta*, the basal angles more broadly rounded; elytra scarcely more than one-half longer than wide, but little more than twice as long as the prothorax and not wider, the impressed lines feeble and somewhat irregular, more coarsely punctured. Length 1.4–1.8 mm.; width 0.55–0.75 mm. California (Calaveras, Humboldt, Lake and Los Angeles Cos.)........................ **versicolor**, sp. nov.

11—Vestiture of the elytra stiff and bristle-like 12

Vestiture of the elytra long, slender and hair-like but erect and conspicuous; elytral punctures arranged without order, not at all seriate at any point; last joint of the maxillary palpi acutely pointed........ 25

12—Vestiture more or less distinctly serial in arrangement 13

Vestiture not at all serial at any point, the punctures evenly distributed......... 15

13—Body strongly cylindro-convex, the elytral punctures differing among themselves in size, the larger forming more or less indefinite series; bristles unusually long 14

Body narrow, parallel, distinctly depressed, the punctuation dense, the elytral punctures more uniform in size, the bristles moderate in length, forming close and nearly even series. Pennsylvania to Texas .... **creberrima** *Mell.*

14—Sides of the prothorax becoming straight and parallel behind the middle. *Male* —Body subcylindric, somewhat shining, castaneous in color, the bristles coarse, erect, longer than the width of the scutellum, subserial on the elytra; head moderate, the front flat, the eyes small; clypeal margin feebly reflexed, remotely and feebly bituberculate, a small sinus just without each tubercle and thence strongly oblique for some distance to the eyes; prothorax nearly as long as wide, circularly rounded at apex, narrowly subsinuate at the middle; angles obtuse; base finely margined; surface very obsoletely, transversely impressed at apex; punctures uneven in size, small, deep, not very close-set; scutellum pointed behind;

elytra two-thirds longer than wide, equal in width to the prothorax and barely twice as long, obtuse at apex; series of coarse punctures scarcely impressed. *Female.*—Nearly similar to the male, the clypeal margin evenly arcuato-truncate, the prothorax not modified. Length 2.4–2.9 mm.; width 0.9–1.1 mm. Utah (southwestern)................................. **mormonica**, sp. nov.

Sides of the prothorax subparallel and evenly arcuate throughout. *Male.*—Similar to *mormonica* in the modifications of the clypeus and prothorax, pale piceous, polished, the bristles long, stiff and erect, subserial on the elytra; eyes small; prothorax fully one-third wider than long, the angles obtuse; punctures moderately fine, deep, somewhat uneven in size, rather close-set; elytra less than twice as long as wide, as wide as the prothorax and barely twice as long; punctures rather coarse and close-set, the larger only partially forming indefinite and scarcely at all impressed series. Length 2.0 mm; width 0.85 mm. Pennsylvania (Westmoreland Co.)......................... **horridula**, sp. nov.

15—Body obese and strongly convex, suboval; male sexual characters pronounced, the female also having the apex of the prothorax at least feebly bilobed; apical angles of the anterior tibiæ everted and acute externally..................16

Body subcylindric, convex; male sexual characters feeble, the clypeus finely bituberculate; maxillary palpi slender; prothorax margined at base, the angles obtuse...21

16—Clypeus angulate at each side near the eyes in both sexes.................17

Clypeus emarginate in the middle and bidentate, not angulate near the eyes......20

17—Elytra very nearly one-half longer than wide.............................18

Elytra very short, scarcely one-third longer than wide.........................19

18—Elytral punctures rather close-set. *Male* with the clypeal margin reflexed and quadridentate, the apex of the prothorax with two broad porrect triangular processes, separated by a rounded sinuation. California.......... **vitula** *Mann.*

Elytral punctures rather sparse, the integuments more shining. *Female.*—Body elongate-oval, very convex, polished, castaneous, the legs, antennæ and sometimes the anterior parts paler; bristles of the prothorax very small and rather fine, not conspicuous, of the elytra coarse, moderately long and rather sparse; head concave apically, the clypeus broadly rounded and obscurely quadrangulate; eyes rather small; prothorax one-fourth wider than long, the sides feebly convergent and very feebly, evenly arcuate from base to the rather obtuse but somewhat prominent apical angles; base transverse, very feebly lobed at the middle, very finely margined; apex advanced, rounded and feebly bilobed; punctures fine and moderately close; scutellum obtuse, wider than long; elytra as wide as the prothorax and slightly less than twice as long, perfectly even, the punctures deep, very much larger than those of the pronotum. Length 2.3–2.5 mm.; width 1.15 mm. California (Humboldt Co.)............. **illustris**, sp. nov.

19—*Female.*—Body stout, oval, strongly convex, pale in color, polished, the elytral bristles very short, those of the prothorax rather inconspicuous; head nearly as in *illustris*, less concave anteriorly, the eyes very small; prothorax nearly as in *illustris* but shorter, nearly one-half wider than long, the punctures very small and rather sparse; surface occasionally with a very obsolete median canaliculation near the apex; elytra very short, scarcely two-thirds longer than the prothorax, strongly convex, obtusely rounded behind, the punctures rather

coarse but feebly impressed and quite sparse. Length 2.1 mm.; width 1.0 mm. Louisiana .... **congesta**, sp. nov.

20—*Male.*—Cylindric-oval, not very stout, strongly convex, pale in color probably from immaturity, rufo-testaceous, shining; bristles very stout but short, distinct and rather close on the prothorax, somewhat sparse on the elytra; head and eyes rather well developed, the front flat; clypeus strongly reflexed, triangularly bidentate; prothorax two-fifths wider than long, the sides rather strongly convergent and arcuate from base to apex, the latter reflexed and triangularly bidentate; base truncate; punctures quite coarse, deep and close-set; elytra less than one-half longer than wide, four-fifths longer than the prothorax, the punctures about equal in size to those of the pronotum but sparser. Length 1.4 mm.; width 0.6 mm. California .... **duplex**, sp. nov.

21—Prosternum normally convex; anterior tibiæ externally everted and acute at apex; scutellum small, not wider than long; prothorax rounded at the apex; male with the first ventral simple. *Male.*—Body narrowly cylindric-oval, moderately convex, piceous-black, with the legs and antennæ pale; surface shining; bristles coarse, pale, erect, moderately sparse, even in length on the elytra; head and eyes small; clypeal margin feebly reflexed, bituberculate; prothorax nearly as long as wide, parabolically rounded anteriorly, with a small and very feeble median sinuation, the sides becoming straight and parallel toward base; punctures fine but perforate, rather close-set; elytra rather more than one-half longer than wide, as wide as the prothorax and twice as long, the punctures rather coarse, well separated and subeven in size. Length 2.0 mm.; width 0.7 mm. California (Lake Tahoe) ....**hystricula**, sp. nov.

Prosternum broadly and feebly biconcave; anterior tibiæ thickened and rounded externally at apex; scutellum larger; prothorax feebly sinuate from above at the converging sides of the apex; maxillary palpi with the last joint more acutely pointed; male with the first ventral foveate at the middle.................22

22—Eyes small, the body more elongate and cylindric.........................23

Eyes large and well developed; body stouter and more cylindric-oval...........24

23—Antennal funicle longer than the club. *Male.*—Moderately convex and shining, rather pale castaneous, the bristles stiff, moderately long and rather abundant; head rather well developed, the clypeal tubercles small and separated by a fourth of the entire width; prothorax nearly a fourth wider than long, rounded and somewhat lobed at apex, the sides becoming nearly straight and parallel toward base; punctures rather strong and close-set though not very coarse; elytra one-half longer than wide, as wide as the prothorax and rather more than twice as long, the punctures quite coarse, impressed and somewhat close-set. Length 1.75–1.8 mm.; width 0.75 mm. Montana (Missoula).....**montana**, sp. nov.

Antennal funicle equal in length to the club. *Male.*—Dark rufo-piceous, the elytra black, the legs and antennæ pale, shining, the bristles stiff, erect and pale but rather sparse throughout; head well developed, the minute tubercles of the clypeus separated by a little more than a fourth of the width; prothorax nearly as in *montana* but nearly a third wider than long, with the punctures much less close-set; elytra one-half longer than wide, as wide as the prothorax and rather more than twice as long, the punctures moderately coarse, deep and

not very close-set. Length 1.5–1.7 mm.; width 0.65–.75 mm. Vancouver Island, Washington State and Northern California............**soror**, sp. nov.

24—*Male.*—Black and shining, the anterior parts picescent; legs and antennæ pale; bristles rather sparse, short and somewhat inconspicuous anteriorly, longer on the elytra; head well developed, the minute clypeal tubercles separated by a fifth of the width; prothorax nearly as in *soror* but fully two-fifths wider than long, the punctures strong and well separated; elytra suboval, not more than two-fifths longer than wide, rather wider than the prothorax and distinctly more than twice as long; punctures only moderately coarse but deep and quite sparse. Length 1.6–1.75 mm.; width 0.75 mm. New York.
curtula, sp. nov.

25—Anterior tibiæ everted and acute externally at apex; hairs very long, a fifth or sixth as long as the entire width of the elytra. *Male.*—Body stout, cylindric, polished, piceous in color, the vestiture very long and bristling, abundant; head and eyes moderately developed; front feebly concave; clypeus with two long slender erect and widely separated processes; prothorax slightly wider than long, the sides just visibly convergent and nearly straight from base nearly to the apex, then rounding and strongly convergent to a trapezoidal and obliquely upturned lamina, which is subtriangularly emarginate at tip; surface with rather strong and close-set punctures, feebly impressed at apex behind the lamina; elytra short, cylindric, obtuse at apex, two-fifths longer than wide, as wide as the prothorax and three-fifths longer, the punctures rather coarse, even, moderately close-set, the surface not at all rugose. *Female.*—Smaller than the male, the clypeus feebly reflexed at each side; prothorax shorter and more transverse, simple. Length 1.75–2.1 mm.; width 0.75–0.9 mm. Florida (Lake Worth)...**hirsuta**, sp. nov.

Anterior tibiæ simple at apex, not dilated or produced; hairs shorter, about an eighth as long as the entire width of the elytra. *Female.*—Oblong-oval, moderately convex, shining, pale rufo-testaceous, the vestiture only moderately abundant and not dense; head moderate, the eyes small; clypeal margin feebly reflexed at each side; prothorax nearly one-half wider than long, parabolically rounded at apex, the sides becoming parallel and nearly straight behind the middle; punctures fine and rather sparse, elytra suboval, rather ogival at tip, two-fifths longer than wide, rather wider than the prothorax and more than twice as long, the punctures somewhat coarse but feeble, well separated; humeral callus rather small and feeble. Length 1.4 mm.; width 0.65 mm. Alabama.
ursulina, sp. nov.

Fuscipes is our most abundant species, and the west coast *impressa* resembles it very much in external appearance. Mellié states that the anterior margin of the head in the male of *fuscipes* is surmounted by two very small tubercles; this is not the case in the representatives before me, but as Mellié included with his American specimens some from Madeira, it is probable that he had one of these under observation, and that it is a species different from *fuscipes*. *Vitula* of Mannerheim, is assigned to *Ennearthron* in the Henshaw list, but without

reason, as it is in no way related to that genus, and the *Cis dichrous*, of that list, is a manuscript name, appearing only in the LeConte list of Coleoptera. *Hirsuta* and *ursulina* are remarkable in having long fine and bristling pubescence. *Hystricula* seems to have the elytral bristles vaguely inclined to serial arrangement, and it is undoubtedly more closely allied to *mormonica* than to the three species immediately following it in the table. The Alaskan *Cis ephippiatus*, of Mannerheim, (Bull. Mosc., 1853, p. 234), is omitted from our lists. It is unknown to me, but seems to be peculiar in having the elytra profoundly and remotely, subseriately punctate, red, with a large common transverse black spot at the middle, which attains the margin at each side.

Orthocis, gen. nov.

This genus is very closely allied to *Cis*, but differs in the more parallel form of the body, in its glabrous surface, margined elytral suture and absolutely simple apex of the anterior tibiæ. The maxillary palpi are rather stout, the ligula large and corneous, the antennæ long, with the two basal joints of the funicle elongate and the club rather small and loose. The head and clypeus are absolutely simple in the male, and the only visible male sexual character is a small oval opaque and densely pubescent area at the centre of the first ventral segment, at the point occupied by a deep circular fovea in some species of *Cis*. Our two species greatly resemble each other but may be distinguished as follows :—

Ligula broader and flat; third antennal joint nearly or quite as long as the next two combined; body rather less elongate, the sides of the prothorax somewhat less rectilinear, otherwise similar to the following. New York .... **punctata** *Mell.*

Ligula narrow and convex; third antennal joint distinctly shorter than the next two combined. *Male.*—Oblong, parallel, moderately convex, polished, black, the legs and antennæ rufous, glabrous, each puncture of the elytra with a very minute simple silvery hair; head well developed, convex, the eyes small and prominent; clypeal margin perfectly simple, evenly arcuate from side to side; prothorax two-fifths wider than long, the sides parallel and straight, rather widely reflexed; apex broadly arcuate and slightly advanced; angles obtuse; base finely margined: punctures rather fine but deep, well separated; elytra two thirds longer than wide, rather wider than the prothorax and nearly two and one-half times as long, obtusely ogival at apex, the sides very feebly arcuate; punctures confusedly arranged, rather small but deep and somewhat sparse, the surface smooth; elytral suture margined toward tip. Length 2.3–2.5 mm.; width 0.85 mm. California (Alameda Co.) .... **aterrima**, sp. nov.

Xestocis, gen. nov.

A few species of peculiar facies are separated under this name, because of the prosternal carination. The antennæ are of the normal structure, with the club well developed and the second funicular joint only slightly longer than wide. The anterior tibiæ are strongly oblique and acute externally at apex, except in *opalescens*, where the external angle is slightly thickened and rounded. The maxillary palpi are usually rather slender. The first ventral segment is subfoveate and densely pubescent at the centre of the disk in the males. Our five species are strongly differentiated among themselves, and may be described as follows:—

Boby glabrous...2

Body clothed with short pubescence or bristles............................3

2—Clypeus bidentate in the male, the prothorax simple and rounded at apex in both sexes. *Male.*—Suboval, very dark rufo-piceous, sometimes paler, polished; head and eyes moderately developed; prothorax two-fifths wider than long, the sides just visibly convergent from base to the obtuse apical angles, rather distinctly and evenly arcuate; lateral margin very fine, the base finely margined, more distinctly in the middle; punctures minute and rather sparse; elytra less than one-half longer than wide, twice as long as the prothorax and barely wider, rather narrowly rounded at apex, very feebly subrugulose, minutely, sparsely punctate. Length 1.5–1 9 mm.; width 0.7–0.85 mm. Canada (Toronto), New Jersey, Pennsylvania, Indiana and Iowa........................**levettei**, sp. nov.

Clypeus monocerate in the male, the prothorax with two long slender porrect processes. *Male.*—Oblong-oval, convex, testaceous, polished, glabrous, each puncture with an excessively minute hair; head and eyes moderately developed, the front impunctate, broadly concave, the clypeus reflexed, with a long erect parallel process at the middle, feebly expanding toward apex, the latter very feebly emarginate; prothorax distinctly wider than long, the sides moderately convergent and evenly arcuate throughout, the apex prolonged over the head and with two long remote straight and porrect processes, the surface behind their separating sinus broadly impressed; punctures fine, not very sparse; elytra short, one third longer than wide, twice as long as the prothorax at the median line and somewhat wider, rather rapidly and narrowly rounded at apex, the sides arcuate; surface nearly smooth, minutely, rather sparsely punctate. *Female.*—Nearly similar to the male, the clypeus broadly sinuate at the middle, the prothorax broadly rounded at apex. Length 1.2–1.35 mm; width 0.55–0.6 mm. Pennsylvania (Westmoreland Co) and Rhode Island (Boston Neck)..**miles**, sp. nov.

3—Upper surface normal; vestiture distinct, even but arranged without order; punctures of the elytra intermingled with larger sparse punctures, which are sometimes disposed in vague series; clypeus bidentate in the male...............4

Upper surface covered with a waterproof crust, through which the extremely minute simple hairs protrude...5

4—Vestiture composed of small simple and subdecumbent hairs *Male.*—Oblong-oval, moderately convex, rufo testaceous, feebly shining; prothorax wider than

long, minutely but strongly, closely punctate; elytra two-fifths longer than wide, ogivally rounded at apex, finely, rather closely punctured and vaguely subrugose. Alaska (Sitka) and Queen Charlotte Islands (Massett).....**biarmata** *Mann.*

Vestiture composed of coarse stiff and suberect squamules. *Male.*—Slightly smaller than *biarmata* but similar, oblong-oval, moderately convex, testaceous, feebly shining, the bristles short and abundant; head rather small, feebly concave, the eyes moderate; clypeus triangularly reflexed at each side; prothorax nearly one-half wider than long, the sides just visibly convergent, feebly and evenly arcuate; angles obtuse; apex subangularly produced and rounded, with the tip very narrowly sinuato-truncate; punctures moderately fine, deep and quite dense; elytra not quite one-half longer than wide; less than twice as long as the prothorax and somewhat wider, feebly rugulose, minutely and rather closely punctate, the punctures smaller than those of the prothorax; apex ogivally rounded. Length 1.6 mm.; width 0.7 mm. Pennsylvania (locality not recorded). **insolens**, sp. nov.

5—*Male.*—oblong oval, rather stout, only moderately convex, polished, dark piceo-testaceous; head moderate, the eyes small but prominent; front broadly concave, the clypeus acutely, bitriangularly reflexed; prothorax one-half wider than long, the sides very feebly convergent, rather strongly, evenly arcuate; apex subtriangularly prolonged, with the tip minutely emarginate and feebly reflexed; punctures rather fine but distinct, slightly separated; lateral margins narrowly reflexed; elytra short, scarcely a third longer than wide, as wide as the prothorax and four-fifths longer, the apex rather acutely ogival; surface not very finely, evenly and rather closely punctate. Length 1.4–1.6 mm; width 0 6–0 75 mm. Pennsylvania (Westmoreland Co.)....................**opalescens**, sp. nov.

Biarmata is misprinted "*bicarinatus*" in the Henshaw list.

Brachycis, gen. nov.

The chief peculiarities of the single type of this genus are the short and suboval form, very short, transversely excavated prosternum and obsolescent side margin of the prothorax at the rounded and obtuse apical angles. The antennal club is strongly developed, as long as the preceding six joints combined and has the sensitive apical pores small but deep and bristling with white setæ, thus leading up to the remarkable *Plesiocis* which follows. The maxillary palpi are rather slender and acutely pointed, and the anterior tibiæ are finely, acutely and almost perpendicularly produced externally in a well-marked process. Sexual characters are wanting in the single specimen before me, which is probably a female:—

Broad, moderately convex, oblong-oval, piceous, the elytra, legs and antennal shaft paler rufo-testaceous; body clothed above with stiff pale and erect setæ, moderate in length and density, uniformly distributed; head rather small, the eyes moderate; clypeus simple, subtruncate; prothorax two-thirds wider than long;

angles rounded, the sides strongly convergent and broadly arcuate from base to apex, the latter broadly subparabolic, not extending much over the head; punctures not very coarse but deep, rather close-set; elytra oblong, very broadly, obtusely rounded at apex, one-fourth longer than wide, two and one-half times as long as the prothorax, and, at apical third or fourth, visibly wider; sides nearly straight; punctures rather coarse, deep and somewhat close-set, the surface nearly smooth. Length 1.4 mm.; width 0.75 mm. New York (Ithaca)
brevicollis, sp. nov.

Plesiocis, gen. nov.

This genus, which is also represented at present by a single species, is remarkably distinct in the structure of the antennæ, which are 9-jointed, with the club large and well developed, more corneous than usual, dark in color and with the two sensitive subapical pores on each side large, rounded and filled with white spongy pubescence; the club is nearly as long as the entire basal portion, with its first two joints transverse and obtriangular. The maxillary palpi are well developed, but rather slender, the prosternum normal, the process however rather thin and sublamellar. The anterior tibiæ are strongly, obliquely produced and acute externally at apex. The male has very simple characters, the clypeus having two minute and rather approximate tubercles, but the first ventral segment has, as in so many other cases, a small pubescent fovea at the centre of the disk. The type resembles a large subcylindrical *Cis*:—

Body cylindric-oval, strongly convex, piceous-brown, shining, the legs and antennal shaft rufous; vestiture rather sparse, the hairs coarse, pale, stiff and erect, moderate in length; head rather small, the eyes moderate, convex; front flat, finely punctate; prothorax two-fifths wider than long, the sides feebly convergent and slightly arcuate, the basal angles rather broadly rounded, the apical obtusely subprominent; lateral margin narrowly reflexed; base finely margined; apex broadly rounded, slightly produced over the head; punctures coarse, perforate and close set; elytra one-third longer than wide, twice as long as the prothorax and scarcely at all wider, the sides nearly straight, the apex very broadly and obtusely rounded; punctures coarse, perforate, close-set and arranged evenly but without order, the interspaces smooth. Length 2.1–2.3 mm; width 1.0–1.1 mm. California (Mokelumne Hill, Calaveras Co.)........**cribrum**, sp. nov.

Ennearthron *Mellié*.

The small cylindrical species which compose this genus may be readily identified by the characters given in the table. The antennæ are slender, with the club rather feeble, the first joint of the funicle generally equal to the next two, which, with the last are equal and moniliform. Prosternum moderately developed before the coxæ, with

the process very narrow and sublamellar. The male characters are always pronounced and generally affect both the clypeus and thoracic apex, but these characters greatly diminish in degree in the smaller and less developed males, these depauperate individuals not differing much from the females in either the present genus or *Ceracis*. In both of these genera the male also has a small deep pubescent fovea, not at the centre, but near the posterior margin, of the first ventral segment. The characters of the following table are taken throughout from what appear to be fully developed males only:—

Male with the clypeal margin broadly and strongly reflexed in a trapezoidal process, the thoracic process bidentate.......................................2

Male with a long slender erect clypeal process, the thoracic apex simple and rounded; species very small.......................................11

2—Elytra without trace of impressed lines.......................................3

Elytra with very feebly and unevenly impressed lines, the punctures feebly subserial in arrangement.......................................10

3—Male with the thoracic processes longer, narrower and more approximate; punctuation feeble, the elytral punctures always confused in arrangement. Atlantic and Gulf regions.......................................4

Male with the thoracic processes shorter, more widely separated and more lamellarly triangular; punctuation stronger, the elytral punctures generally confused but occasionally very feebly subserial. Pacific Coast regions.......................................6

4—Apex of the pronotum rather feebly impressed behind the processes...........5

Apex of the pronotum strongly, transversely impressed behind the processes. Moderately slender, polished, piceo-rufous in color; head well developed, concave, the clypeal process large and well developed, with the apex feebly sinuate at the middle; prothorax slightly wider than long, the sides parallel and nearly straight, the angles all rounded; processes long, slender and distinctly diverging as usual; base and sides finely margined; punctures fine and sparse; elytra less than one-half longer than wide, as wide as the prothorax and two-thirds longer, the surface very feebly subrugulose, sparsely and very minutely punctate, the punctures much more minute than those of the pronotum; apex evenly rounded. Length 1.2–1.5 mm; width 0.45–0.6 mm. Texas (Columbus) and Louisiana.
piceum, sp. nov.

5—Elytra fully one-half longer than the prothorax, slender, cylindric oval, black, rather strongly shining; legs, mouth parts and antennæ pale; punctures fine and rather sparse; thoracic processes rather short. Canada to Pennsylvania (*melli* Mell., *unicolor* Csy.).......................................**thoracicorne** *Zieg.*

Elytra very short and quite strongly cuneiform, very much less than one-half longer than the prothorax. Rather stout, the head polished and concave, the eyes small; clypeal process well developed but with the sinuate sides rather rapidly converging, the apex a little less than half as wide as the head, feebly sinuato-truncate; prothorax large, not quite as long as wide, the sides parallel and broadly arcuate, the corneous processes moderately long and rather stout; punctures fine but distinct, only moderately sparse; elytra at base as wide as the

prothorax, the sides nearly straight and distinctly convergent, the apex narrowly rounded; punctures rather sparse and very minute, the surface feebly rugulose. Length 1.3 mm.; width 0.53 mm. Louisiana (Morgan City).
laminifrons, sp. nov.

6—Thoracic process of the male abruptly formed............................7
Thoracic process gradually formed, its sides merging gradually and obliquely into the sides of the prothorax; thoracic punctures quite dense......................9

7—Elytral punctures rather coarse and closer; thoracic process one-half as wide as the elytra. Body rather stout, blackish, the elytra piceous; legs and oral organs pale; lustre moderately shining; head and eyes moderately developed; clypeal process very broad, only moderate in length, almost transversely truncate; prothorax only slightly wider than long, the sides parallel and broadly arcuate; apical process very broad, deeply sinuate; punctures strong and close-set; elytra quite distinctly narrower than the prothorax and scarcely more than one-half longer; one-half longer than wide, the sides parallel; apex broadly rounded; surface feebly rugulose, strongly punctured, less closely than the prothorax. Length 1.4–1.7 mm; width 0.55–0.7 mm. California (southern)............**grossulum**, sp. nov.
Elytral punctures fine but distinct, rather sparse, the thoracic process much less than one-half as wide as the elytra..8

8 Thoracic punctures close-set; angles of the clypeal process scarcely at all rounded. Blackish, the elytral punctures generally very feebly subserial in arrangement. California (especially northern coast regions)............**californicum** *Csy.*
Thoracic punctures sparse; angles of the clypeal process rounded. Body evenly cylindric, moderately shining, more or less rufo-testaceous in color, the elytra sometimes blackish toward base; head and eyes moderate, the clypeal process moderately strong, with the sides rather strongly convergent and the apex broadly sinuate; prothorax slightly transverse, the sides parallel and almost straight, rounding anteriorly, the process rather feebly developed, sinuate at apex; elytra scarcely one-half longer than wide, as wide as the prothorax and three-fifths longer, the sides parallel and straight, the apex broadly rounded; punctures fine and sparse, the surface almost smooth. Length 1.2 mm; width 0.5 mm. California (Sonoma Co.)..............................**discolor**, sp. nov.

9—Narrowly cylindric, blackish, the elytra rufescent at tip; legs, trophi and antennæ pale; surface moderately shining; head well developed, the clypeus moderate in length, with the sides strongly convergent, the apex broadly sinuato-truncate and the angles blunt; prothorax but little wider than long, the sides subparallel and very slightly arcuate; process rather short, sinuate at tip; elytra fully one-half longer than wide, as wide as the prothorax and fully three-fourths longer, somewhat parabolically rounded at tip, the punctures fine but strong, but little smaller than those of the prothorax and much less close-set. Length 1.1–1.3 mm.; width 0.4–0.5 mm. California (Los Angeles)...**convergens**, sp. nov.

10—Moderately stout, piceous to blackish in color, with the elytra paler; legs, trophi and antennæ pale, the club dusky; surface polished; head well developed, broadly concave, the clypeus only moderately reflexed, the apex broadly truncate; prothorax but little wider than long, the sides subparallel and broadly, distinctly arcuate; process rather short, lamelliform, with a triangular incisure at the middle, the process abruptly formed; punctures very fine and sparse; elytra short,

less than one half longer than wide, scarcely as wide as the prothorax and one-half longer, evenly rounded at apex, the punctures minute and sparse, those of the series larger and closer. Length 1.0–1.2 mm; width 0.4–0.5 mm. Florida. **pullulum**, sp. nov.

11—Narrowly cylindric-oval, moderately shining, pale flavo-testaceous throughout; head and eyes well developed, the front concave; clypeal process narrow, long, the apex strongly rounded; prothorax distinctly wider than long, the apex evenly and circularly rounded, the sides becoming parallel toward base; punctures very minute, sparse and feeble; base distinctly margined as usual; elytra fully as wide as the prothorax and two-thirds longer, not quite one-half longer than wide, parabolically rounded at tip, margined at base, the punctures sparse, very feeble and extremely minute, even smaller than those of the prothorax; surface smooth. Length 1.0–1.1 mm.; width 0.4–0.45 mm. Florida...... **unicorne**, sp. nov.

Unicorne is evidently closely related to the Brazilian *corniferum* of Mellié, but in that species the cephalic process is said to be broad, recurved and narrowed to the acute apex.

Ceracis *Mellié*.

This genus is scarcely distinct from *Ennearthron*, agreeing in facies and in every structural feature except the antennæ, which are 8-jointed, one of the small joints of the funicle being eliminated. The swo species before me are as follows:—

Rufo-testaceous, the elytra blackish toward base; punctures very minute and sparse, the remaining characters nearly as in *punctulata*. Louisiana [Mellié], North Carolina and Pennsylvania (Westmoreland Co.)................. **sallei** *Mell.*

Black throughout, the head and prothorax sometimes picescent; legs, trophi and antennæ pale; surface polished, the elytra nearly smooth; head and eyes well developed; clypeal process rather well developed, with its sides but slightly converging, the apex broadly sinuato-truncate; prothorax slightly shorter than wide, the sides feebly convergent and broadly arcuate from the base to the rather pronounced but obtuse apical angles; process very abruptly formed, moderate in length, the exterior angles somewhat everted and the apex deeply sinuate; punctuation quite deep and close-set but rather fine; base finely margined; elytra at base as wide as the prothorax, less than one-half longer than wide; the sides nearly straight and feebly convergent; apex broadly rounded, base not in the least margined; punctures finer and sparser than those of the prothorax, confusedly arranged. Length 1.25–1.3 mm.; width 0.55–0.6 mm. Florida. **punctulata**, sp. nov.

The species recently described from Lower California by Dr. Horn, under the name *similis*, appears to resemble *sallei*, but differs from both the above in having the elytral punctures coarser than those of the prothorax, a very exceptional character in *Ennearthron* and *Ceracis*.

Octotemnus *Mellié.*

This is a very pronounced and distinct genus, differing from *Ennearthron* in the oval outline of the body, absence of male sexual characters of the head and prothorax, and in tibial structure. The maxillary palpi are slender and pointed, the antennal club well developed and very loose, the joints being attached by very slender pedicels and with the sensitive pores approximate at each side of the apex. The prosternum is short and somewhat concave before the coxæ, with the process thin and laminate. There is no fovea on the first ventral segment of the male, but the surface is feebly and approximately bi-impressed near the base, the intervening area elevated and prolonged backward in an isolated triangular point, a structure not suggested elsewhere in the family. The surface is glabrous, but the elytra have a few widely dispersed erect setæ. Our two species are very closely allied; they may be described as follows from the male:—

Form more narrowly oval; size larger, the basal abdominal process of the male very acute at apex, pale testaceous, polished throughout; head and eyes well developed, the latter convex; front broadly, evenly convex, very minutely, sparsely punctate; clypeal margin slightly thickened for a short distance from the eyes; prothorax but little wider than long, circularly rounded at apex, the sides diverging slightly to the base; angles all very broadly rounded; base very minutely margined; punctures very minute, feeble and sparse; elytra fully one-half longer than wide, a little wider than the prothorax and nearly twice as long; sides feebly arcuate, the apex rather narrowly parabolic; base not margined; humeral callus very small, feeble; surface feebly rugulose, the punctures extremely minute and sparse. Length 1.4–1.75 mm.; width 0.55–0.75 mm. Pacific coast (from Vancouver to San Francisco).... ....**denudatus**, sp. nov.

Form rather shorter and more broadly oval, polished, the pronotum more or less alutaceous, blackish to pale flavo-testaceous throughout; head and prothorax nearly as in *denudatus*, the elytra barely one-half longer than wide, distinctly wider than the prothorax and barely twice as long, the surface nearly smooth, very minutely, sparsely punctate. Length 1.35–1.6 mm.; width 0.6–0.65 mm. Rhode Island, New York and Pennsylvania.................**lævis**, sp. nov.

Both of these species are very common, and it is remarkable that they have not been heretofore described. Perhaps the *Cis pumicatus* of Mellié may be the same as *lævis*, but that species, taken apparently near New Orleans, is said to have the prothorax longer than wide and the elytra only one-half longer than the prothorax, which language agrees rigorously also with the figure and in no way suits either of the above species.

SPHINDIDÆ.

This family forms a very good transition to the Cryptophagidæ. The antennæ are of a more perfectly clavicorn type than in Cioidæ, and have a large compact club, with the ninth joint variable in size. The mentum is very large, in striking contrast to the Cioidæ, where it is unusually minute. The maxillary palpi are small, slender and pointed and the anterior coxæ rather widely separated. The clypeus is convex, continuous with the front, narrowed and continued over the larger part of the mandibles, the labrum being small, almost atrophied in *Odontosphindus*, the epistomal suture fine and posteriorly arcuate. The eyes are large, convex and coarsely faceted. The two genera before me may be distinguished as follows:—

Tarsi heteromerous; antennæ 11-jointed, the ninth joint wider than the eighth, but very short, the club virtually 2 jointed, large and nearly cylindric; prothorax denticulate at the sides, the elytra with impressed series of coarse punctures; body glabrous .... **Odontosphindus**

Tarsi pentamerous; antennæ 10-jointed, the club variable, 2 or 3-jointed; prothorax not denticulate, the elytra with unimpressed series of fine punctures; body sparsely pubescent.. **Sphindus**

Another genus, *Eurysphindus*, has been described by LeConte, but I have seen no example; the inferior flanks of the prothorax are said to be deeply concave and the body clothed with erect hair.

Odontosphindus *Lec.*

These species are much larger than those of *Sphindus* and are distinguishable at once by the characters of the table; the two species are as follows:—

Sides of the prothorax scarcely at all reflexed, finely margined. Atlantic regions. **denticollis** *Lec.*

Sides of the prothorax distinctly though not very broadly explanato-reflexed, more strongly and quite irregularly denticulate. Body subparallel, moderately convex, pale rufo-testaceous in color, shining though somewhat alutaceous in lustre; head moderate in size, the epistoma polished and impunctate; eyes moderately large, convex; antennæ as long as the width of the head, the first joint large, the second more slender, contorted at base as usual; prothorax quite transverse, parallel, the sides feebly arcuate; punctures rather coarse and close set; elytra only just visibly wider than the prothorax, three-fourths longer than wide, the serial punctures obsolete toward tip. Length 3.0–3.5 mm.; width 1.25 mm. California (Sonoma Co.).. **clavicornis**, sp. nov.

Clavicornis is materially larger than *denticollis*, and has a larger, more transverse and more coarsely punctured prothorax.

Sphindus *Chev.*

The species of this genus are small and oblong, with duller surface lustre and moderately long, rather sparse pubescence, serial in arrangement on the elytra. The three species before me may be thus separated:—

Antennal club 2 jointed...2

Antennal club purely 3-jointed..3

2—Pronotum minutely and rather closely punctured, more or less rufo-piceous in color. Atlantic regions to Iowa ....**americanus** *Lec.*

Pronotum more coarsely and quite sparsely punctured. Body black, stouter, dull in lustre; head and eyes moderate in size, the epistoma polished; antennæ a little longer than the width of the head, the club only moderately stout, the tenth joint twice as long as the ninth; prothorax nearly twice as wide as long, the sides just visibly convergent from base to apex, feebly arcuate; apex broadly arcuate; elytra scarcely a fourth longer than wide, barely wider than the prothorax and two and one-half times as long; serial punctures rather fine, the intervals dull and minutely shagreened. Length 1.9 mm.; width 0.9 mm. Colorado (Buena Vista—8000 feet)...................................**crassulus**, sp. nov.

3—Narrowly oblong, more shining, piceous black, the elytra, legs and antennæ pale testaceous; head moderate, the eyes large and convex, separated by about three times their own width; antennæ moderate in length, the last three joints forming a compact subcylindric club; prothorax much smaller than in the two preceding species, transverse, the sides subparallel; surface evenly convex, very minutely and not very closely punctulate; elytra two-fifths longer than wide, about a fifth wider than the prothorax and three times as long; serial punctures feeble but distinct, the intervals smooth and alutaceous; apex obtusely rounded as usual. Length 1.7 mm.; width 0.7 mm. Canada (Toronto).
trinifer, sp. nov.

Americanus varies greatly in size as usual in this and neighboring families; it is quite abundant and occurs in fungi of various species.

THE LIFE-HISTORIES OF THE NEW YORK SLUG CATERPILLARS.—XV.

PLATE VI, FIGS. 1–11.

BY HARRISON G. DYAR, A.M., PH.D.

Heterogenea flexuosa *Grote*.*

1880—*Limacodes flexuosa* GROTE, North Am. Ent. I, 60.

1880—*Limacodes cæsonia* GROTE, North Am. Ent. I, 60.

1894—*Heterogenea cæsonia* and *flexuosa* NEUMOEGEN & DYAR, Journ. N. Y. Ent. Soc. III, 74.

LARVA.

1878—GLOVER, Ill. North Am. Ent. pl. 95, fig. 19.

1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 105 (as "full grown larva of *Heterogenea* sp.").

1895—DYAR & MORTON, Journ. N. Y. Ent. Soc. III, 146 (in synopsis).

1896—DYAR, Journ. N. Y. Ent. Soc. IV, pl. VI, figs. 3 and 4 (as *Tortricidia pallida*).

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space narrow, of even width, scarcely narrowing at the ends, gently arched; joint 13 rounded prominent. Lateral space broad, oblique, narrowing to the extremities; subventral space small, retracted. Subdorsal ridge slight; indicating the change in direction between back and sides; lateral ridge rather prominent, overhanging the subventral space. Outline elliptical, joint 13 only slightly notched on the sides, not forming a quadrate tail. Depressed spaces (1)-(8) present, the subventral ones (7) and (8) only indicated, the others sharp edged and deep, large, dividing the surface into latticed ridges as in *Tortricidia pallida*, (4) the largest, transversely elongated, the lower segmental (5) moderate, the intersegmental (6) very small, alternating exactly in line with the lower edge of (5). Skin surface covered with coarse clear granules, the depressed spaces finely granular in the base. In the first stage the setæ are arranged as in *T. pallida*, but disappear at the first molt when all the structural characters are assumed nearly in their mature form. Coloration of the pattern and colors of *T. pallida*, modified in detail.

* This is not a *Heterogenea*; but I reserve generic corrections till the end of these articles.

AFFINITIES, HABITS, ETC.

This larva is very closely allied to *T. pallida*, but differs in several characters, nearly all of which are a higher specialization. In stage I the setæ are smaller, not so distinctly alternating and the anterior limb of the Y-shaped spines is slightly shortened. After the first molt the setæ are nearly obliterated, being much more reduced than in *T. pallida*. The granules are smoother, more appressed, not subpapillose on the lateral ridge as in the younger stages of *T. pallida* and the depressed spaces are, if anything, larger. The red mark appears at the same time or sooner than in its ally, but is never so large. It does not exceed the lateral extension of *T. pallida* of stage V even in the last stage, VII, though the longitudinal extension is the same in both in the case of the most heavily marked *H. flexuosa*. The amount of variation is perhaps not greater in *flexuosa* than in its ally, though the breaking up of the red band gives the appearance of greater diversity.

The moths emerge during the last week in June and lay the eggs singly on the backs of the leaves. The favorite food plant is the chestnut and the larvæ occur on the lower of the main branches of this tree, not on the low shoots nor on any but the old matured leaves. The oak is also a food plant; I have found the larvæ abundantly on *Q. coccinea*, very rarely on *Q. alba*. The larvæ mature early in September. This species occurs scattered all over New York State, usually rare, but occasionally locally common. I have taken it in most of the wooded parks around New York City and at various places in Long Island. The present life-history was completed from a newly hatched larva which I found in Bronx Park after a two days' search, in which I was kindly assisted by Mrs. P. N. Knopf and Miss L. I. Hoff.

CRITICISM OF PREVIOUS DESCRIPTIONS.

Dr. Packard has described this larva without knowing what it was. I have made an unfortunate error in the description of *Tortricidia pallida* (Journ. N. Y. Ent. Soc., IV, 170-1), and included characters of *H. flexuosa* in stages II, III and VI. The figures on the plate of the young larva (figs. 3 and 4) represent stages IV and VI of *H. flexuosa*. The text of *T. pallida* will be specifically corrected in the "additions and corrections" to follow at the end of these articles.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Elliptical, flat as usual; 1.1×.7 mm., the shell colorless, white.

Stage I.—Rounded elliptical, tail round; skin smooth, depressed a

little dorsally above the bases of the tubercles in paired hollows. All colorless. Setæ Y-shaped in the subdorsal row on joints 4–11, the front limb a little shorter than the back one (Plate VI, fig. 1); two setæ on joints 3 and 13; a middle row of two on each of joints 3 and 4; a single lateral row on joints 3–12. Tips of setæ a little enlarged, not distinctly swollen. Subventral setæ very fine, obscure, all pale. Head colorless, eye black; body whitish, food greenish. Length, .9–1.4 mm.

Stage II.—Narrowly elliptical, tail rounded quadrate; dorsum broad and flat, the subdorsal ridge forming its sharply angled edge. Smooth, regular, all the depressed spaces (1) to (6) large and very distinct. Sides concave, lateral ridge smooth; subventral area retracted. Latticed ridges covered with smooth, dense, frosted, appressed granules, one row wide, uniform, not papillose anywhere. Setæ absent. Color opaque whitish; later distinctly pale green. Length, 1.3–1.8 mm.

Stage III.—Rounded, rather broadly elliptical, sides concave at first so that the dorsum stands up as a broad ridge gently arching from head to tail. Tail slightly notched at the sides, rounded. Depressed spaces very distinct, (4) narrowly elongate. Latticed ridges beaded with clear appressed granules, not generally over one granule wide in the narrower parts. Bottoms of the spaces finely granular, dotted, the larger ones with shallow, saucer-like centers. Color green; a yellow line appears along the subdorsal ridge on joints 5–9, widened a little on each segment. Usually no other marking, but there may be a small, faint, or even distinct dark red dot between the lines on joint 8, or surrounding the depressed space (1) of joints 7–8. Length, 1.8–2.4 mm.

Stage IV.—Rather narrowly elliptical; tail rounded quadrate. Dorsum rather narrow, a little grooved at first. Lateral ridge extending beyond the subventral one. Depressed spaces large and sharp, the latticed ridges scarcely more than one granule wide, but the granules becoming wedge-shaped. All smooth, no setæ. Color light green, the yellow subdorsal lines reaching joints 5–10. The dorsal yellow mark varies from a narrow yellow bridge on joint 8 to a red bar on joints 7–8 (see the plate of *T. pallida*, pl. IV, fig. 3) or even a rather large round red patch, which does not encroach on the subdorsal lines. Length, 2.4–3.2 mm.

Stage V.—Shape as in the mature larva; tail rounded, scarcely notched at the sides. Dorsum not broad, sides oblique, concave. Latticed ridges several granules wide, smoothly evenly granular, a little frosted. Spaces finely shagreeened with a circular shallow saucer-like centre. Color green, spaces not discolorous except a little yellow in

(4); a yellow subdorsal line on joints 3–12, not quite reaching either extremity, the pair unconnected at the ends, but centrally on joints 6–9, broadened to the top of the depressed spaces (4) and enclosing in the dorsal space a reddish patch on joints 7–8 with salmon-colored margin and dark brown latticed ridges. In some examples a reddish mark appears on joint 3 between the subdorsal lines. Length, 3.2–4.3 mm.

Stage VI.—Structures as before, tail rounded quadrate. Depressed spaces large, the latticed ridges closely clear granular. Green, the large lateral depressed spaces (4) shaded with yellow. The yellow subdorsal lines reach joints 3 and 13, entirely free * or joined by a yellow bridge on joints 7 to 9 containing a red spot of varying form, corresponding to the variety of the larva. In an example from Bellport, Long Island, the spot was cordate, the depression in front, pink and edged with a crimson line. In another it was in the form of a cross, darker, shaded with brown on the latticed ridges and encroaching on the subdorsal line. (See *T. pallida*, pl. VI, fig. 4.) In others the shape was circular, or of the form of the "club" or "spade" as usually depicted on playing cards. There is also another spot at the anterior end. In the Bellport larva it was elliptical, covering joint 3 dorsally, bright red and edged with yellow. In another from Fort Lee, N. J., it was shaded with dark brown like the central spot. It was present in a larva which lacked the central spot entirely. Length, 4.2–6.3 mm.

Stage VII.—(Plate VI, figs. 5 to 9.) Shape as described. Dorsal space of uniform width, scarcely narrowing anteriorly. Skin rather regularly coarsely watery granular on the latticed ridges, the depressed spaces narrow, finely granular. Color pale yellowish green, pigmented in the dorsal and upper half of lateral space, clearer green below. All the depressed spaces yellow in the bottom, the largest with glandular green centers. Subdorsal line yellow, straight from joint 3 to the tail, rather broad. On the anterior edge of joint 3 a red mark, widened along the edge, produced backward in the dorsal space more or less. The central dorsal red mark is very variable. It may be absent (Plate VI, fig. 8) or represented only by a narrow yellow bridge on joint 8 slightly red tinted (Plate VI, fig. 9). The usual form is a rounded cross, reaching on the sides nearly or quite to the lateral depressed spaces (4) and in the dorsal space on joints 7 to 9; it may be enlarged to a hexagon (Plate VI, fig. 6) or extend in a dorsal band the whole

* Out of 263 larvæ which were found in an oak woods at Yaphank, L. I., only three were entirely without the yellow bridge (Plate VI, fig. 8).

length (Plate VI, fig. 5). The color is crimson, marked with purplish brown or blackish on the latticed ridges in the place of the usual spots, a more or less distinct square pale spot covering the depressed space (I) of joints 7–8. Length, 6.3–10 mm.

Cocoon as usual.

Food-plants.—Chestnut, oak, hickory, wild cherry.

EXPLANATION OF PLATE VI.

Fig. 1. Stage I, side view enlarged, diagrammatic.
" 2. One of the single setæ more enlarged.
" 3. Larva in stage III enlarged.
" 4. Granules from young larva.
" 5. Mature larva, enlarged, full pattern.
" 6. The same, widest spot.
" 7. Front and side views.
" 8. Mature larva, most reduced pattern.
" 9. The same, a small red spot.
" 10. Moth of *Heterogenea flexuosa.*
" 11. The same, variety *cæsonia.*

NOTES ON SPECIES OF NOCTUA WITH DESCRIPTIONS OF NEW FORMS.

PLATE VII.

BY JOHN. B. SMITH, SC.D.

In 1890 I published a revision of the species theretofore lumped under the generic term *Agrotis*, as Bulletin No. 44 of the U. S. National Museum, and divided up the species among fifteen genera, new and old. The general conclusions reached in that paper have approved themselves to me since that period; but the increased material has necessitated some changes in the standing of certain species.

The genus *Noctua* as restricted by me contained species with all the tibiæ spinose, the anterior not heavily armed; front smooth and feebly convex; antennæ in the male ciliate only; vestiture hairy, scaly or mixed; primaries with apices rectangular or rounded, and as a whole rather subparallel, if varying in width.

Nothing essential need be added to this description, and all the new forms since seen fit very nicely into the definition. Most of the addi-

tions have come from the northern portion of our country and emphasize the character of the genus as one of either high altitude or high latitude. It is quite probable that a few species yet remain to be discovere l and these will in all likelihood be rather close allies to something already described.

The receipt of material from Manitoba and Calgary has, within the past few years, added considerable to our knowledge of the species of this genus and a very interesting example of close relationship is recorded here.

The additions above referred to have also enabled us to gain a better idea of the specific standing of some of our species and some of these facts are here recorded.

Noctua smithii *Snellen.*

Tijdschr. voor Entomologie, XXXIX, 157.

baja ‡Smith.

Bulletin 44, U. S. Nat. Mus. 78.

All authors who had written on the subject up to the date of Snellen's paper have assumed the identity of the European and North American examples labelled *baja*. Speyer, Zeller, Moeschler and Grote have all examined specimens from both countries and considered them as representatives of one species only. In the Revision above cited I pointed out that both Lederer and Speyer refer to the anterior tibiæ as unarmed, while in all the specimens seen by me they were spinose. Unfortunately I had no European examples for comparison, hence could only suggest the question: "whether we have not here as in the case of *triangulum* and *normaniana*, distinct species." Snellen has carefully compared specimens from both countries and finds the European form with constantly unarmed fore tibiæ. He therefore names the American form as above, while the structural difference thus brought out, assigns *baja* to my genus *Rhynchagrotis*. It is certainly remarkable that so well marked a structural difference should separate species superficially so much alike.

Snellen prefers to separate the European species on a somewhat different basis from that proposed by me, and does not accept my genera for their comparatively small number of forms. It must remain for the student with collections from all countries for comparison, to decide as to the advisability of subdivision and to select the basis for it.

It is also pointed out that *Carneades* Grt., is long since preoccupied by Bates, in Coleoptera. If the rule is to be strictly enforced, Mr. Grote's term must give way, probably to *Chera* Hubner.

Noctua hospitalis *Grote.*

Of this species I knew only the female type from the Hill collection in 1890. Mr. Grote was inclined in 1886 to consider this a form of *perconflua*, but as I pointed out, it is much nearer to the European *brunnea*. Two years ago Dr. Ottolengui took a perfect male at Manchester, N. H., which he kindly gave me, and recently I saw a specimen in the Strecker collection, labelled simply "N. Y."

The latter specimen was named *brunnea* and, compared with European examples in the same collection, no superficial differences were apparent. In view of what has appeared in other instances—notably that of *baja*—it would be unsafe to cite the two as identical; hence I present a picture of the male genitalia (Plate VII, fig. 9) for comparison with those of the European *brunnea* by any one with specimens of the latter at hand.

Noctua rubifera *Grt.*

There has been much confusion in collections between *rubifera* and *perconflua*, and even labels in Mr. Grote's handwriting are not always correctly applied. When the western forms were added, leading to *rosaria*, the confusion became yet greater and there seemed to be almost no line of division. *Esurialis* Grote, described from Washington I referred from a comparison of types in 1891 as a probable geographical race of *perconflua*.

Within the last five years I have received material in this group from all the Pacific Coast States, from Vancouver, from British Columbia, from Manitoba and from Calgary, and the result of a renewed study has been the conclusion that there are more species than has been realized, and that even in the East two species have been confused under the name *rubifera*. Fortunately Mr. Grote gives us a figure of his species (Can. Ent., VII, pl. I, f. 14), and of this type I have four examples from Orono, Me., Sharon Springs and the Adirondack Mountains, New York.

The sexual characters of the two males agree, and are not those figured by me on pl. IV, f. 37, Bull. 44 U. S. Nat. Museum. They are represented on the accompanying Plate VII, fig. 2. This species has the primaries rather narrow, especially in the male, the apex almost rectangular, outer margin evenly curved and the inner margin nearly straight. None of the ornamentation is at all contrasting, yet in most specimens a diffuse darker median shade is traceable.

Noctua cynica, sp. nov.

This species reminds one of *Orthodes cynica* in wing form and general appearance, hence I give it the same name. As compared with *rubifera*, with which it has been confused, it is much broader winged, with both costal and inner margins curved at least as decidedly as in *perconflua*. In maculation it does not differ from *rubifera*, except in the lack of a median shade in the specimens before me. But this may not be permanent, and I attribute most value to the wing form and the totally different genitalia of the male. It was this form that I dissected to illustrate *rubifera* in pl. IV, f. 37 of Bulletin 44, already cited, and a new figure is given on pl. VII, fig. 3, herewith. The differences between the two are simply in details and partly due to a difference in mounts. My examples are from the vicinity of Albany, N. Y.

It is not impossible that one or the other of these forms may really be the same as the European *rubi*, or the latter may even agree with one of the western forms. Unfortunately I have none for comparison.

Noctua jucunda *Wlk.* =*perconflua* GRT.

This species has approximately the wing-form described for *cynica*, but is more brightly marked. All the specimens I have seen are distinctly mottled or shaded with yellow and the transverse lines are more irregular. The reniform is more regularly kidney-shaped and both spots are mottled, the orbicular quite usually open above.

The male was not before me in 1890, and a figure of the genitalia is presented herewith on pl. VII, fig. 4. It will be seen at once that it is of the same type as in *cynica* while yet very different in detail, and it shows that the new species follows its ally in wing form rather than that most like it in ornamentation.

Noctua calgary, sp. nov.

At various times Mr. F. H. Wolley Dod has been sending me examples which I have not been satisfied to place with either *rubifera* or *rosaria*, but named *rosaria*, I think. The recent receipt of specimens bringing the number up to three males and one female—a much better series was unfortunately ruined in sending—makes it possible for me to decide that we have a new species to deal with. Superficially it is distinct by the more trigonate primaries, which have rectangular apices, the outer margin straight to vein 3, then forming an obvious though obtuse angle inwardly. In all the specimens the ordinary spots are gray powdered and the median shade is obvious. The s. t. space is the darkest part of the wing in all examples and contrasts with the pale ter-

minal space. This is exactly opposite to what is usually found in *rubifera* and *rosaria*, and by this and the wing form the species may be recognized, I think.

The sexual characters of the male are quite different from those of the other allied species and are figured on plate VII, fig. 5. The derivation is evidently from the *rubifera* type, but is modified in both harpe and clasper at least as much as is indicated by the difference in wing form.

The examples before me vary in the amount of contrast in the ornamentation. In one specimen the space between the ordinary spots is black filled; in another it is still a little darker than the ground color; the others are intermediate. The female has the outer half of the median space darker than the basal portion of the wing; but this is probably not a sexual characteristic.

The dates given are in June and July and one specimen is marked bred from larva beaten from sallows at night. Mr. Dod writes that he bred two examples and that the species is not uncommon.

Noctua rosaria *Grt.*

This species I have from British Columbia, Washington and the Sierra Nevada, California. It is like *rubifera* in size and wing form but the ground appears more even, while yet the ordinary spots seem more mottled. The specimens have a somewhat more rusty shading, which yet gives the impression of a velvety surface. It is almost impossible to put the difference into words; yet it exists and is visible on comparison, while its importance is demonstrated by the genital characters which are shown at plate VII, figs. 6 and 7. The differences between the two figures is that between a flat mount (fig. 6) and one in a cell (fig. 7); the latter showing the natural curves and position of parts.

Noctua esurialis *Grt.*

I have specimens from Corfield, Vancouver and from Portland, Oregon, which I take to be this species. The specimens from Vancouver agree perfectly with Mr. Grote's description and with my notes on the type when I referred it as a probable geographic race of *jucunda*. The latter it is decidedly not, but I am not certain that it is not a form of *rosaria*. Compared with the latter it seems somewhat broader winged and dirtier; darker and more sordid in color. Yet the differences are scarcely tangible and as my material is almost all from electric light globes it leaves something to be desired.

The genital structure of the male indicates a good species, but leaves

some doubt. The differences will be found in comparing fig. 8, in plate VII, with those cited for *rosaria.* The chief point is in the much narrower harpes and this amount of variation I have not seen equalled elsewhere in the same species. Three males, one from Corfield and two from Oregon are practically identical, while three specimens of *rosaria* from the three localities represented are also practically the same.

This study of the forms allied to *rubifera* will serve to indicate that our knowledge of the species is by no means even yet complete and that much remains to be done. The material in collections even of the Eastern forms is altogether insufficient in amount and character to fairly illustrate the species. All the examples of the forms referred to here should be preserved for careful study.

Noctua inopinatus, sp. nov.

Among the material received from Mr. A. W. Hanham, Winnipeg, Manitoba, are specimens that I have named *haruspica* with some doubt. Other examples from Corfield, Vancouver and 264 (Gillette) Colorado, have increased that doubt and I venture the above name to indicate a form intermediate between the eastern *haruspica* and the western *sierræ.* In size the new species averages less than *haruspica* and the color is as a whole more evenly smoky and with less red. The ordinary spots are somewhat better relieved, while the median lines tend to become broken and incomplete, while yet the detached parts may be well marked.

In all other respects, including sexual structure of the male, the agreement is with *haruspica* and the species may be deemed an impressionist one, rather than one based on sharply definable characters. Plate VII, fig. 1, illustrates the sexual pieces, the figure given in my Revision having been made, as now appears, from an imperfect specimen.

Noctua treatii *Grt.*

Since I wrote in 1890 this species has turned up in several places and is now well represented in a number of collections. To the locality given in my catalogue must be added Jefferson, N. H.; Adirondack Mountains, N. Y.; Central Maine and Calgary, Canada. None of the examples seen approaches in size the specimen referred to in my Revision and now in the U. S. National Museum.

Noctua exuberans, sp. nov.

Ground color gray, varying from reddish to almost ashen, more or less irrorated. Head without markings; palpi deep brown at the sides. Collar with the lower half deep sienna brown. Thorax otherwise without markings. Primaries with the median lines obsolete, except on costa where the basal, t. a. and t. p. lines are indicated by black spots. A median shade is indicated by a brownish cloud. In one

specimen it is possible to trace a vague t. a. line part way across the wing. The s. t. line is indicated but is broken, a little paler, principally marked by the slightly darker terminal space and toward the costa also by a dusky preceding cloud. The orbicular is wanting in the specimens before me. The reniform is small, kidney shaped, black; but with indefinite outlines and incomplete superiorly. Secondaries whitish, iridescent, becoming smoky at the margin, where there is a brown terminal line setting off the white fringes. Beneath whitish, a little powdered at the margins, the primaries a little darker than the secondaries, and in one specimen almost smoky. Expanse, 1.60 inches = 40 mm.

Habitat : Glenwood Springs, Colorado, in July; Dr. Barnes.

Three male specimens are before me, each differing a little in color; but otherwise very similar. The species is allied to *lubricans;* but is larger and with much less trace of the ordinary markings, while on the other hand the reniform is much more distinct. In most of the examples of *lubricans* the transverse lines may be made out. In this species there is no appearance of them except on the costa. Two of the specimens are uniform in color, although different in shade. The third specimen is ashen gray along the costa and in the terminal space, while the rest of the wing has a reddish cast. The species reminds one somewhat of *incivis*, but the wing form is different.

In sexual characters the insect agrees in general with the group in which I have placed it, and is one of those showing no very characteristic features. It is represented in Plate VII, fig. 10.

Noctua bolteri, sp. nov.

Ground color red with a violet tinge The markings rusty brown and black. The vestiture of the head and thorax is defective, hence it is impossible to say whether or not they are maculate. Basal line geminate, black, emphasized by brown scales, continuing to the submedian vein and from that point obliquely outward to the inner margin. At this point there is an oblique brown shade which marks the middle of the lower half of the median space. In the cell there is, almost midway between the basal and t. a. line, an upright black mark which is inwardly margined by yellowish scales. T. a line geminate, the outer part black, the inner brown; included space marked with yellow scales. As a whole the line is nearly upright to the submedian vein and then with a strong outcurve to the inner margin. T. p. line geminate, lunulate, with a square outward bend over the cell, then incurved below; made up of black lunules followed by yellow scales and outwardly margined by a rusty brown, rather broad and nearly even line. S t. line yellow, irregular, forming a W on veins 3 and 4, preceded by a distinct brown shade which becomes blackish toward the costa. A series of black terminal lunules, which are outwardly marked with yellow. There is a brown, irregular median shade. Claviform large, filling nearly the entire space between the median and submedian veins; outlined by black scales within which is a yellow line, and the whole is filled with brown. Orbicular large, oval, incomplete above, outlined by black scales within which is a yellow annulus. Reniform very large, broad, hardly kidney shaped, outlined with black scales, then annulate with yellow; the center with a whitish lunule. Secondaries smoky gray, the

fringes almost white, a vague trace of a discal lunule showing from below. Beneath primaries pale, powdered along the margin with carmine scales, and with a vague discal spot. Secondaries with a more distinct discal spot and incomplete outer line. Expanse, 1.32 inches = 33 mm.

Habitat: Las Vegas, New Mexico, July 11th.

A single female specimen was received from Mr. A. Bolter, after whom I have named this most remarkable insect. It is totally unlike any other of the described species in every respect and at first sight recalls some of the *Plusiid* forms allied to *Diastéma;* yet it has all the characters of the genus *Noctua* to which I refer it, and in this genus it stands by itself. Its occurrence in New Mexico contradicts the general distribution of the genus which I have elsewhere referred to, and the male may present characters which will induce the reference of the species to some other genus.

Noctua plebeia, sp. nov.

Ground color a dirty clay yellow, with blackish powderings which give it a sordid appearance. Head and thorax without obvious markings. The tip of the collar paler, the general shading of the thorax a little darker than the primaries. There is an obvious divided anterior and posterior tuft. All the markings are traceable, though all are more or less incomplete. Basal line geminate, black, extending to the submedian vein. T. a. line geminate, black, incomplete both parts of the line almost equally distinct; as a whole with a very slight outcurve. T p. line blackish, powdery, geminate, very even, feebly bisinuate. S t line consisting of a series of very black spots which may become partly united into a broken line, and outwardly margined by a few yellowish scales. There is a series of brown or blackish terminal lunules, beyond which is a yellowish line at the base of the fringes. There is a diffuse median shade which is hardly marked on the costa; but is obvious below the median vein. The claviform is outlined by brown and black scales and filled with brown. Orbicular moderate in size, oval, rather irregular, outlined by pale scales, black filled. Reniform large, kidney shaped, outlined by yellowish and brown scales, and filled with black. The space between the ordinary spots is brown. Secondaries smoky fuscous, the fringes considerably paler. Beneath, smoky, powdery, the primaries darker; the secondaries with a very distinct large discal spot and a broad median line. On the primaries similar marks are traceable. Expanse, 1.40 to 1.60 inches — 35 to 40 mm.

Habitat: Vancouver, August 14th; Livingston. British Columbia; California.

I have two males and one female, and have seen other specimens; one at least from Oregon, and I think also a specimen or two from Washington. The California specimen is the only female and is, I believe, from some point in the Sierra Nevada Mountains. This species is very well marked and is unlike any others of those that are described. In a general way it is allied to *baja*, or, as it must now be known, *smithii*,

but the most obvious difference and the one that will enable this species to be readily recognized is in the black filled ordinary spots. In this character the species is unique. The insect gives the impression, somehow, of a dirty creature.

The male parts are very simple, consisting of a single upright corneous process on a broad triangular harpe.

Setagrotis elata, sp. nov.

Ground color ash gray, varying in general shade from a yellowish to a bluish tinge. Head and thorax without markings of any kind. Primaries with all the markings obscured and very feebly traceable. The median lines are always visible as geminate black costal spots, but beyond that they are only vaguely indicated. In a general way and so far as can be indicated the t. a. line seems to be a little outcurved between the veins, and as a whole a little outcurved in its course. The t. p. line is even, with an even outcurve over the cell and an almost equally even incurve. The s. t. line is whitish, irregular, broken, well defined by a blackish preceding shade and by the somewhat darker terminal space. The claviform is merely indicated by a few black scales. Orbicular round, of moderate size, incompletely defined by a few black scales, within which is a somewhat more distinct circlet of yellowish scales. The reniform is moderate in size, also incompletely outlined by black and yellow scales, the lower portion filled with blackish and forming quite a prominent feature in the markings of the wing. Secondaries in the male white, with a vague smoky outer margin and a narrow discal lunule. In the female more smoky, with a blackish outer margin and discal lunule. Beneath whitish, powdery, with a more or less marked outer line and discal spot on both wings. Expanse, 1.50–1.60 inches = 36–40 mm.

Habitat : Colorado.

I have three specimens, two males and one female, received from Professor C. P. Gillette, and numbered 565, 2610 and 2732. The specimens differ considerably, and yet resemble each other quite closely, The female is the larger and much the darker. All the specimens agree in showing the black filled reniform and pale, dark bordered s. t. line. as the only prominent features in the wing.

EXPLANATION OF PLATE VII.

Fig. 1. Harpe and clasper of *Noctua inopinatus*, male.
" 2. " " " *Noctua rubifera*, male.
" 3. " " " *Noctua cynica*, male.
" 4. " " " *Noctua jucunda*, male.
" 5. " " " *Noctua calgary*, male.
" 6. " " " *Noctua rosaria*, male.
" 7. " " " *Noctua rosaria*, male.
" 8. " " " *Noctua esurialis*, male.
" 9. " " " *Noctua hospitalis*, male.
" 10. " " " *Noctua exuberans*, male.

All the figures are drawn with a camera lucida and to the same scale.

NEW SPECIES OF NOCTUIDÆ FROM TROPICAL AMERICA.

BY WILLIAM SCHAUS.

Noctua herculeana, sp. nov.

Head and thorax reddish brown. Abdomen gray. Primaries at the base violaceous, limited by a geminate velvety black basal line; the antemedial line partly geminate, oblique and not reaching the inner margin, most heavily marked on the costa; the space before the antemedial line grayish; the median space violaceous brown; orbicular indistinct, partly surrounded by black; the reniform large, diffuse, whitish gray; the postmedial line fine, geminate, followed by a row of small spots; the postmedial space light brown, followed by the broad dark violaceous brown margin. Secondaries smoky brown. Expanse, 60 mm.

Habitat: Trojes, Mexico.

Agrotis aureolum, sp. nov.

Head golden yellow. Collar and thorax concolorous, dark reddish brown. Primaries similar to *Agrotis malefida* Gn, but browner and the postmedial line more distinct. Secondaries pure white. Expanse, 40 mm.

Habitat: Castro, Parana.

Agrotis perotensis, sp. nov.

Body light reddish brown. Primaries light reddish brown; the lines very fine and slightly darker; basal and antemedial lines somewhat oblique and hardly wavy; the postmedial very slightly curved beyond the cell and marked by minute points on the veins; subterminal line wavy, paler than the ground color and inwardly shaded with darker brown especially towards the costa; orbicular large, very oblique; reniform large, kidney shaped, both spots olive brown, surrounded by a pale line. Secondaries white with a slight reddish brown tinge; fringe darker; discocellular well marked. Expanse, 41 mm.

Habitat: Las Vigas, on the Cofre de Perote. Elevation 10,000 ft.

Agrotis oaxacana, sp. nov.

Body very dark brown, almost black. Primaries blackish brown; lighter brown along the basal half of costa to below cell; the antemedial and postmedial lines geminate, indistinct; a subterminal light brown shade crossed on veins 4 and 5 by black streaks; claviform very small; orbicular and reniform hardly perceptible; some light brown spots at the base of the fringe. Secondaries smoky black, whitish towards the base; fringe golden. Expanse, 39 mm.

Habitat: Oaxaca, Mexico.

I have only received 2 ♀ ♀ of this distinct species.

Agrotis molepa, sp. nov.

♂. Antennæ pectinated. Head and thorax light reddish brown. Abdomen yellowish white. Primaries light reddish brown; antemedial line replaced by three black spots, on costa, median and submedian veins; postmedial line punctiform, black, hardly curved on costa and parallel with outer margin; reniform small, black. Secondaries pearly white. Expanse, 36 mm.

Habitat: Castro, Parana.

What I consider as the ♀ of this species has the primaries dark reddish brown with transverse black striæ, making the costal margin much darker; orbicular represented by a black point; reniform small, black. Secondaries white, thinly speckled with black. Expanse, 42 mm.

Habitat: Castro, Parana.

Amathes gasiva, sp. nov.

Head and thorax dark gray, the scales tipped with white, and a black central line on the collar. Abdomen brown with a subdorsal basal tuft of dark gray scales. Primaries dark gray; the basal line black, indistinct; the antemedial line black, outwardly curved between the veins; the postmedial inwardly curved between the veins, more narrowly black, but very distinct and followed by a line of dark scales; the subterminal wavy, lighter gray, preceded and followed by a brownish shade; the veins on outer margin blackish; the claviform outlined in black; the orbicular and reniform large, tinged with brown and irregularly outlined with black; a broad dark brown median shade crossing the wing between the spots. Secondaries brown, whitish towards the base; a terminal white line. Underneath light grayish with a minute discal spot and postmedial line. Expanse, 28 mm.

Habitat: Las Vigas, Mexico. Elevation 10,000 ft.

Strongly resembles *A. tesselloides* Grote.

Amathes yaxcaba, sp. nov.

Head and thorax gray, the anterior portion of collar velvety black. Abdomen light grayish brown. Primaries gray, minutely speckled with black; a basal black line not reaching the inner margin; the antemedial line diffusely angulate, irregular, sometimes only visible on the costal margins; the postmedial represented by a black spot on costa; the subterminal most indistinct, forming a faintly darker shade near costa; reniform indistinctly and unevenly outlined in black. Secondaries white, with a fine terminal brown line. Underneath primaries and costal margin of secondaries grayish. Expanse, 33 mm.

Habitat: Orizaba, Mexico.

This species is allied to *A. lubricans* Gn, and the ♀ is easily distinguished by the white secondaries.

Mentaxya butleri, sp. nov.

Body light gray. Primaries silvery gray with all the markings very indistinct; a basal interrupted line; a geminate antemedial and a geminate postmedial line

darker gray; a median and a subterminal reddish brown shade; the orbicular and reniform finely outlined in dark gray. Secondaries white, the margins faintly shaded with brown. Expanse, 30 mm.

Habitat: Jalapa, Mexico.

There is a specimen of this species in the B. M. from Rio Janeiro.

Mentaxya biformis, sp. nov.

Head and thorax gray with a reddish or black spot anteriorly on the collar. Primaries gray, crossed by numerous transverse brownish striæ; a minute dark basal spot on the costa; the antemedial line straight, inwardly oblique, crossing the claviform which is represented by a small black spot; outer line curved beyond the cell, indistinct; orbicular absent; reniform small, reddish brown. In the ♀ the lines and reniform are also absent. Secondaries pearly white in the ♂, the margins shaded with brown in the ♀. Expanse, 33–36 mm.

Habitat: Sao Paulo, S. E. Brazil.

I may here mention that *Mentaxya lucilla* Btl., is a synonym of *A. messium* Gn.

Anicla mahalpa, sp. nov.

Head and thorax light gray or pale buff, the anterior portion of thorax sometimes reddish or velvety brown. Primaries light gray or pale buff with transverse darker striæ, and thinly speckled with black; a few reddish scales in the cell and subterminally; the outer margin irregularly dark gray; a terminal row of dark points; three dark points on the costa; orbicular absent; reniform spotted and surrounded by small black sagittate marks. Secondaries and fringe pearly white. Expanse, 38 mm.

Habitat: Castro, Parana.

The peculiar reniform and pearly white secondaries distinguish this species from *A. incivis* Gn., to which it is otherwise allied.

Carneades colima, sp. nov.

Head and thorax brownish yellow. Primaries brownish yellow, brightest along the costal margin and at the base; two small dark brown basal spots, below the costa and median vein; antemedial line dark brown, angular; postemedian line punctiform on the veins, connected by a lunate shade; the subterminal very fine, indistinct; the extreme margin brownish with a terminal row of black points; orbicular represented by a brownish patch; reniform large, kidney shape, brownish, circled with yellow. Secondaries white with an interrupted dark terminal line. Expanse, 41 mm.

Habitat: Colima, Mexico.

Carneades cofrensis, sp. nov.

Head and thorax grayish; collar with a black posterior line. Abdomen light brown. Primaries light green, mottled with brown; basal and antemedial lines white, connected by a brown patch below the median vein; some brownish shades on the costa and a large white spot above the median vein; space between spots and before

orbicular brown; claviform large, brown; orbicular greenish, speckled with brown and broadly circled with white; reniform large, indistinctly outlined and shaded with brown and partly margined with white; postmedial line brown, denticulate, outwardly shaded with white and outwardly preceded by a brown shade below the reniform; subterminal indistinct, forming a broad shade; a terminal row of triangular black spots; fringe gray. Secondaries light gray, with a darker terminal line and the discal spot of the underside clearly visible. Expanse, 35 mm.

Habitat: Las Vigas on the Cofre de Perote, Mexico. Elevation 10,000 feet.

Polyphænis psittacea, sp. nov.

Head and thorax bright green. Abdomen brown with a few subdorsal greenish tufts. Primaries bright green; the lines brown, geminate; the antemedial irregular wavy, the basal straight, the postmedial crenulate; the subterminal shade heavy and irregular, brown, followed apically by some brownish spots; a terminal crenulate black line. Secondaries reddish brown, paler towards the base; an interrupted darker terminal line; the fringe partly green. Underneath primaries reddish brown; secondaries lighter brown, with a discal spot, postmedial line, and broad marginal band all reddish brown. Expanse, 35 mm.

Habitat: Aroa, Venezuela. Jalapa, Mexico.

Polyphænis aurea, sp. nov.

Head and thorax bright green. Abdomen golden yellow with a brownish subdorsal line. Primaries bright green; basal marks blackish, irregular, antemedial line brown, geminate from costa to median vein only, then single, fine angular to inner margin; postmedial line fine, black, wavy, deeply curved beyond the cell, and bordering a large brown median space on the inner margin; vein 6 black, from postmedial line to outer margin; subterminal shade only visible at apex. Secondaries golden yellow with a large apical reddish brown spot. Primaries below with the basal half and inner margin golden yellow, otherwise dark brown; secondaries below golden yellow with a broad brown band on the apical half of the outer margin, and a small brown spot on the costal margin. Expanse, 40 mm.

Habitat: Aroa, Venezuela.

Mamestra zobira, sp. nov.

Body dark brown, paler dorsal tufts on the abdomen. Primaries dark violaceous brown, the lines fine, black; the basal line outwardly, the antemedial line inwardly shaded with reddish brown; the postmedial line crenulate, outwardly shaded with reddish brown; the subterminal broken into an irregular row of reddish brown spots, inwardly shaded with black, the spot at inner angle being the largest; a few minute pale spots on the costa; the orbicular absent; the reniform indistinct, mottled with reddish brown scales. Secondaries whitish in the disc, otherwise black. Expanse, 31 mm.

Habitat: Orizaba, Mexico. Jamaica, W. I.

Mamestra janeira, sp. nov.

Body dull brown. Primaries reddish brown, darker along the costa and outer margin; the lines fine, black, basal line geminate, angular; antemedial line geminate, wavy; postmedial line crenulate, followed by points on the veins; subterminal line punctiform outwardly shaded with yellowish brown; orbicular large, dark, finely outlined in black and fusing with the darker costal margin; reniform light reddish brown, partly outlined in black, with a minute white spot in its lower portion; a dark median shade curved, and connected to the lower portion of the reniform by a dark line. Secondaries dull brown; underneath paler with a postmedial dark wavy line and a large black discal spot on the secondaries. Expanse, 35 mm.

Habitat: Rio Janeiro.

Mamestra trocas, sp. nov.

Head and thorax light dull brown; abdomen paler. Primaries light brown, lines darker, very fine and indistinct; the basal and antemedial lines wavy and slightly curved; a dark median shade angled below the reniform; the postmedial geminate, widely apart, broken, almost punctiform; a subterminal row of small black spots, outwardly shaded with white towards the apex; a yellowish white spot at the inner angle; the spots faintly outlined in black, the reniform containing a few yellowish scales. Secondaries light smoky brown. Expanse, 33 mm.

Habitat: Castro, Parana.

This species is closely allied to *M. dotata* Druce.

Mamestra baruna, sp. nov.

♂. Antennæ pectinated, yellow. Head and thorax reddish brown; abdomen grayish brown; anal hairs rufous. Primaries dark reddish brown, the lines indistinct; the antemedial outwardly curved between the veins; a postmedial and a subterminal row of black points; the costal margin and fringe reddish; the orbicular minute, circled with white; the reniform large quadrate, whitish gray. Secondaries pale yellowish with an indistinct marginal shade. Expanse, 40 mm.

Habitat: Castro, Parana.

The ♀ has the primaries rich reddish brown, the veins somewhat darker; the spots as in the ♂. Secondaries brownish black with reddish fringe.

Mamestra subpicta, sp. nov.

Body dark gray; abdomen rufous beneath. Primaries above dark blackish gray, the lines black and indistinct; some mottling from the base to the antemedial line, and the space between the postmedial and subterminal lines, light brown; a terminal row of black points and some brownish spots on the fringe; orbicular small, reniform, large, both light brown circled with black. Secondaries very dark brown, the fringe whitish. Underneath the primaries light rufous along the costa and subterminal space; the cell and apical half of outer margin black; a wavy black postmedial line. Secondaries below whitish, thickly mottled with reddish, scales towards the apex; a

large black discal spot, and the commencement of a broad black antemedial band; a wavy black postmedial line. Expanse, 22 mm.

Habitat: Orizaba, Mexico.

Hecatera marmica, sp. nov.

Head and collar whitish speckled, with black. Thorax dark gray. Abdomen light brown. Primaries blackish gray; the lines indistinct; the basal line followed by a broad white band from the costa to the submedian vein; a broad subterminal white shade interrupted above angle by a dark spot, occupying inner margin from the postmedial line to the angle itself; fringe dark gray, spotted with white; postmedial line denticulate; orbicular dark, hardly discernible; reniform large, mottled gray and white. Secondaries white with the costal margin and a terminal line brownish. Expanse, 30 mm.

Habitat: Oaxaca, Mexico.

Hadena lignaris, sp. nov.

Head and collar light brown: posterior portion of collar and two transverse lines reddish brown. Thorax reddish brown. Abdomen light brown. Primaries reddish brown with numerous longitudinal light and dark brown lines; the transverse lines hardly perceptible, light brown and very irregular; spots small, indistinct with a central dark point. Secondaries brown, semitransparent towards the base; a discal spot. Expanse, 34 mm.

Habitat: U. S. Colombia.

This species is allied ♂ *Hadena ordinarius* Btl., and *H. patina* Harv. Both *ordinarius* and *patina* are common in Mexico and may eventually prove to be the same species.

Alibama scuroba, sp. nov.

Head and thorax blackish brown; abdomen lighter brown. Primaries blackish brown with the markings very indistinct; the lines fine, velvety black; the basal line angular, the antemedial outwardly curved between the veins, the postmedial inwardly curved; the subterminal shade narrow, brown, followed by a dusky dark gray marginal shade; the spots finely outlined in black. Secondaries pearly white with a terminal dark line and some postmedial clusters of dark scales on the veins. Expanse, 30 mm.

Habitat: Sao Paulo, S. E. Brazil.

The female has the outer half of the secondaries black, the base white. Expanse, 36 mm.

This species bears a strong resemblance to the dark forms of *Alibama terens* Wlk.=*A. pulchra* Mösch, but the secondaries are very distinct.

Oligia niveiplaga, sp. nov.

Head, collar and patagiæ light reddish brown; thorax white; abdomen brown. Primaries light brown; the inner margin white, the upper portion of this white space

circular; the lines fine, black, indistinct, not crossing the white portion of the wing; orbicular and reniform finely outlined in black; a broad black streak from the cell across lower portion of reniform to the outer margin; the subterminal shade white, indistinct. Secondaries white, the apex and adjoining portion of outer margin brown; a minute discal spot beneath. Expanse, 27 mm.

Habitat: Aroa, Venezuela.

Oligia apicalis, sp. nov.

Head and collar grayish yellow; thorax reddish gray. Primaries reddish gray speckled with black, forming indistinct lines; the apical portion of the wing beyond the cell and from inner angle dark brown; on the inner margin close to angle a reddish brown shade, above which the indistinct subterminal shade of reddish brown crosses the dark portion of the wing; an apical reddish gray spot. Secondaries brown in the ♀, paler at the base in the ♂. Expanse, 32 mm.

Habitat: Aroa, Venezuela; Castro, Parana.

Oligia thoracica, sp. nov.

Head, collar and thorax light reddish brown, the scales tipped with white; patagiæ dark velvety brown. Abdomen light brown. Primaries brown, slightly mottled with gray; the basal line black, outwardly shaded with white; the antemedial line black, forming three curves and outwardly oblique, the costal portion outwardly shaded with white; the postmedial line white on costa, then finely black, outwardly shaded with white, on which some minute black points are visible to the inner margin; a dark brown shade descends from the costa on the inner side of reniform and joins the postmedial line at vein 2; a black space on the costa beyond the postmedial, and a dark streak between veins 4 and 5; the subterminal shades indistinct, yellowish, followed by some grayish shades; the orbicular round, pure white; the reniform brown, indistinct, surrounded by darker shadings. Secondaries whitish with a marginal brown band; the discal spot and postmedial line of the underside distinctly visible. Expanse, 30 mm.

Habitat: Sao Paulo, S. E. Brazil.

Oligia cadema, sp. nov.

Head and collar reddish brown, thorax gray. Abdomen grayish brown. Primaries brownish gray, palest beyond the postmedial line; basal line indistinct, pale; antemedial line light grey, forming three large curves and outwardly oblique; an inwardly oblique dark shade from the antemedial at the mediah vein to the base of the inner margin; the postmedial line geminate, finely crenulate, the space within partly lilacine; a darker shade to the outer margin between veins 3 and 4; the subterminal shade indistinct, gray, shaded on either side with brown; a very dark line in the cell between the spots; orbicular punctiform, white; reniform large, oblique, grayish, outlined with black. Secondaries in both sexes pearly white, the apex and part of the outer margin smoky; the discal spot and punctiform postmedial brown line of the underside visible above. Expanse, 27 mm.

Habitat: Castro, Parana. Described from seven specimens showing variability.

Trachea paranica, sp. nov.

Head and collar brownish gray. Thorax mottled olive, gray, black and white. Abdomen dark gray. Primaries olive green, thickly mottled with lilacine gray, all the veins being of the latter color; a broad median band being most devoid of mottling; the basal line black, broadly shaded with white outwardly; the antemedial line black, curved between the veins and inwardly bordered with white; the postmedial crenulate, indistinct, slightly shaded outwardly with white; the subterminal broad, white, and very wavy, outwardly shaded with black at the middle of the inner margin and above the inner angle; a terminal row of black points; the margin lilacine gray; orbicular small, grayish; reniform dark circled, indistinct. Secondaries whitish at the base, otherwise grayish black. Expanse, 35 mm.

Habitat: Castro, Parana.

Praina, gen. nov.

Eyes naked. Antennæ pectinated. Fore tibiæ without spines; mid tibiæ with three terminal spines; hind tibiæ with two pairs of spines. Primaries with outer margin rounded; vein 8 and 9 anastomosing to form the areole. Secondaries with veins 3 and 4 slightly stalked. Abdomen long, stout, conical.

Praina radiata, sp. nov.

Head and thorax dark velvety brown; a pale line between antennæ and posteriorly on collar. Thorax pale buff; patagiæ with a broad dark brown band. Abdomen light brown. Primaries pale buff; a broad brown space below subcostal vein, and also below median vein; the submedian shaded on either side with brown; the intervenal spaces on the outer margin dark brown. Secondaries yellowish white with a terminal brown line. Underneath primaries and costal margin of secondaries brown. Expanse, 32 mm.

Habitat: Castro, Parana.

Leucania oriza, sp. nov.

Primaries light pinkish gray with a slightly darker central shade from the base to the outer margin; a few black scales scattered over the wing; the median nervure between veins 2 and 3 faintly white, above which there is a minute black point; a terminal row of black points. Secondaries smoky gray, whitish at the base. Expanse, 30 mm.

Habitat: Orizaba, Mexico.

Leucania jaliscana, sp. nov.

Head and abdomen ochreous; collar light reddish brown with three transverse gray lines. Primaries light ochreous, the subcostal and median veins slightly grayish; the fringe and a triangular shade on the outer margin dark reddish brown; a light reddish brown shade at the end of the cell, and a white spot on the median vein; some antemedial clusters of dark scales below the median vein; a postmedial row of black points. Secondaries white with a terminal fine brown line; the base of the fringe ochreous. Expanse, 32 mm.

Habitat: Guadalajara, Mexico.

Leucania oaxacana, sp. nov.

Head ochreous gray. Collar and thorax light gray speckled with black. Primaries light gray, the veins faintly whitish, black scales scattered over the wing, thickly so along the median vein on which is a white spot containing a black point; a postmedial row of black spots; a terminal row of black spots. Secondaries whitish gray, the veins and a terminal line brownish. Expanse, 33 mm.

Habitat: Oaxaca, Mexico.

Leucania misteca, sp. nov.

Head and thorax reddish gray. Primaries pinkish gray speckled with black; the outer margin darker with long fine black streaks between the veins; a dark central shade from the base to beyond the cell; a minute whitish spot on the median vein; a postmedial and a terminal row of black points. Secondaries white; a terminal row of black spots between the veins; the apex and base of the fringe smoky. Expanse, 35 mm.

Habitat: Oaxaca, Mexico.

Leucania orizaba, sp. nov.

Body reddish gray; the collar posteriorly dark gray, anteriorly with two fine black transverse lines. Primaries light reddish gray, the veins paler, and darker longitudinal streaks between the veins; some black points below the median vein; the postmedial row of black points very much curved, inwardly oblique, geminate from beyond the cell; a whitish speck on the median vein preceded and followed by a broad black streak; a terminal row of black points; a subapical dark shade on the outer margin. Secondaries grayish brown, paler at the base; the base of the fringe yellowish. Expanse, 35 mm.

Habitat: Orizaba, Mexico.

Atethmia targa, sp. nov.

Head and thorax brown, the scales tipped with white. Abdomen rufous brown. Primaries brown powdered with whitish scales, the lines whitish; the basal line almost invisible; the antemedial line somewhat oblique outwardly and shaded with darker brown especially on the basal side; a median brownish shade crossing the reniform which is indistinct; the postmedial line strongly angled beyond the cell and slightly curved inwardly to the inner margin; the subterminal line slightly wavy; the orbicular represented by a brownish dot. Secondaries silvery white; a broken terminal black line. Expanse, 24 mm.

Habitat: São Paulo, S. E. Brazil.

Atethmia editha, sp. nov.

Head and thorax light brown, the scales tipped with white; the collar edged with white. Primaries brown thickly speckled with white scales, the veins finely whitish; all the transverse lines fine whitish; the basal line indistinct; the antemedial line curved on costa, then outwardly oblique to inner margin; the postmedial line the heaviest and followed by a whitish shade, this line and the subterminal being parallel with he outer margin; a terminal lunular brown line; the fringe mottled brown and

gray; the orbicular and reniform distinct and dark, both finely edged with white. Secondaries silvery white in the ♂, smoky in the ♀. Expanse, 30 mm.

Habitat: Castro, Parana.

Atethmia paulensis, sp. nov.

Body pale fawn color. Primaries silvery fawn color crossed by an antemedial, postmedial and subterminal line; these three lines are fine, brown, and angled near the costa; the fringe brownish; the spots not visible. Secondaries white, the fringe and margins narrowly silvery fawn color. Underneath fawn color with traces near the costa of a postmedial and subterminal line; a minute spot at the end of the cell on the primaries. Expanse, 32 mm.

Habitat: Sao Paulo, S. E. Brazil. This species is nearly allied to *A. rectifascia* Grote, from the United States.

Dacira ranapa, sp. nov.

Palpi brown tipped with white. Head white. Collar brown with some white scales posteriorly. Thorax dark brown. Abdomen light brown with a subdorsal white tuft on the first segment. Primaries above with the base dark brown, limited by the antemedial lighter brown wavy line; the median space white; the orbicular and reniform indistinctly outlined in gray, the latter crossed by a smoky brown band, which is slightly oblique from the costa and then forms a single outward curve to the inner margin; the postmedian line denticulate, velvety brown; a large dark brown patch from the reniform to the postmedial line; a brownish patch on the costal margin beyond the postmedial and not reaching the apex; the outer margin yellowish shaded with dark brown on the extreme margin; fringe dark brown; the subterminal represented by a few scattered dark brown scales. Secondaries whitish with the outer margin broadly grayish brown. Underneath whitish; the outer half of the primaries brownish; the secondaries with a wavy, postmedial line, a small discal spot and some grayish scales along the costal margin. Expanse, 23 mm.

Habitat: Castro, Parana.

Cucullia lilacina, sp. nov.

Head and anterior portion of collar dark gray; collar otherwise and thorax light gray; abdomen gray with the dorsal tufts dark brown. Primaries lilacine gray without the usual longitudinal streaks; the base, inner margin, and heavy streak above the inner angle, dark brown; the fringe on the inner margin partly black; the apical portion beyond the cell light reddish brown, becoming darker on the costa, where there are three small white spots; the orbicular of the ground color finely outlined in black; the reniform light reddish brown, indistinct; a blackish shade from the costa, between the spots not reaching the median vein. Secondaries sordid white, the veins and outer margin brownish. Expanse, 40 mm.

Habitat: Orizaba, Mexico.

Cucullia strigata, sp. nov.

Head very dark gray; collar and thorax lighter gray of the same shade as *C. postera* Gn; abdomen still paler, with dark gray dorsal tufts. Primaries same color

as thorax; same general shadings as in *C. convexipennis* Grote, but darker; a long basal streak below the median vein; another dark streak starting on the median vein at a third from the base and continuing along vein 5 to nearly the outer margin. Secondaries sordid white at the base, the outer margin broadly dark brown. Expanse, 45 mm.

Habitat: Jalapa, Mexico. This species bears a similarity to *C. convexipennis* Grote, but the color is quite different.

Chloridea distincta, sp. nov.

Head and thorax light olive green. Abdomen brownish. Primaries light olive green; a brown line inwardly shaded with paler green from close to the apex on the costal margin to nearly the middle of the inner margin. Secondaries brown in the ♀, the fringe white. Secondaries in the ♂ white with a broad brown margin. Underneath primaries brown, with the costa, apex and outer margin gray. Secondaries grayish with a large brown space at anal angle; a postmedial dark line and discal spot. A discal spot also on underside of primaries. Expanse, 32 mm.

Habitat: Sao Paulo, S. E. Brazil.

Acontia obscura, sp. nov.

Head, collar, thorax below, and abdomen of the ♂ ventrally, also the tibiæ, bright orange: tarsi black; the hind tibiæ black at points. Abdomen and thorax dorsally dark greenish black. Primaries dark greenish black. Secondaries bluish black. Expanse, 36 mm.

Habitat: Guadalajara, Mexico.

Acontia trilinea, sp. nov.

Head, collar and body beneath, orange yellow. Thorax orange, the patagiæ bordered with greenish black; abdomen dorsally black. Primaries olive green; the costal vein broadly yellow to nearly the apex; the median vein narrowly yellow, this color extending for a short distance on veins 3 and 4; the submedian vein broadly yellow. Secondaries bluish black. Expanse, 34 mm.

Habitat: Jalapa, Mexico. Possibly an extreme form of *A. obscura* Schs.

Tarache pyralidia, sp. nov.

Head and collar light rufous. Thorax dark brown. Abdomen light brown. Primaries gray shaded with dark brown on the basal third; the outer margin broadly light rufous, inwardly shaded with brown; the fringe brownish. Secondaries whitish, faintly smoky along the outer margin. Expanse, 19 mm.

Habitat: Oaxaca, Mexico.

Tarache axendra, sp. nov.

Head and collar dark olivaceous green. Thorax black. Abdomen brown. Primaries dark olivaceous brown; traces of antemedial and postmedial black lines, beyond the latter clusters of steel gray scales extending toward the apex; similar

clusters on the inner margin ; three large white spots on the costal margin, and a whitish patch close to anal angle ; the extreme outer margin and fringe steel gray ; a terminal row of black spots. Secondaries brown, darkest on the outer margin. Underneath the secondaries are fuscous with a terminal brown shade and some dark spots on the costal column. Expanse, 21 mm.

Habitat: Guadalajara, Mexico.

Tarache mizteca, sp. nov.

Head and thorax dark steel gray. Collar whitish. Abdomen yellowish, Primaries with the anterior half olivaceous and three large spots on the costal margin ; the inner margin dark steel gray, with traces of an antemedial and postmedial dark line ; a large white spot at the anal angle containing some clusters of grayish scales and a terminal interrupted black line. Secondaries white with the outer margins brownish yellow, especially at the apex. Underneath yellowish, the dark portions of the primaries visible. Expanse, 25 mm.

Habitat: Oaxaca, Mexico.

Tarache jaliscana, sp. nov.

Head black. Collar and thorax white. Abdomen brown above, white below. Primaries white, the marginal third of the wing violaceous brown shaded inwardly with olive green ; some terminal patches of lilacine scales, and a double grayish terminal line ; the basal third of the costal margin steel gray. Secondaries white in the ♂ with smoky margins, entirely brown in the ♀. Expanse, 35 mm.

Habitat: Guadalajara, Mexico.

Tarache duenna, sp. nov.

Head creamy white. Thorax grayish. Abdomen dark gray with transverse whitish lines. Primaries violaceous, mottled with brown and black scales ; a large white spot on the centre of the costal margin, inferiorly bordered with olivaceous green ; some whitish scales at the base and also on the outer margin below the apex. Secondaries yellowish white, the outer margin smoky. Expanse, 21 mm.

Habitat: Sao Paulo, S. E. Brazil.

Eustrotia bertha, sp. nov.

Head and collar grayish Prothorax fawn color. Abdomen light brown. Primaries with the basal half creamy fawn color shaded with longitudinal brown streaks ; the outer half lilacine gray with a subterminal white line preceded by some whitish shades ; a few apical dark brown streaks Secondaries white in the ♂ with a terminal brown line, and minute spot in the cell ; slightly smoky at the apex. Secondaries brown in the ♀. Expanse, 20 mm.

Habitat: Sao Paulo, S. E. Brazil.

Xanthoptera auruda, sp. nov.

Body and primaries bright yellow ; a broad transverse orange line, curved beyond the cell and inwardly oblique to the middle of the submedian vein ; the orbicular and reniform represented by orange dots ; a similar dot below the orbicular ; a terminal

brown line; the fringe dark gray. Secondaries pale yellowish, shaded with brown on the outer margin. Expanse, 20 mm.

Habitat: Sao Paulo, S. E. Brazil.

Galgula cuprea, sp. nov.

Head and abdomen brown. Thorax violaceous. Primaries violaceous; the outer margin broadly coppery red; the antemedial line irregular, olivaceous, finely bordered with brown; the postmedial line straight, olive green, divided by a fine brown line and inwardly shaded with dark brown; a small triangular olivaceous patch resting on the postmedial line beyond the cell and having a white line at its base. Secondaries brown. Expanse, 18 mm.

Habitat: Castro, Parana.

Galgula castra, sp. nov.

Body and primaries light violaceous brown. The lines and spots as in *G. partita* Gn., but having in addition a distinct subterminal wavy line. The secondaries are yellowish white. Expanse, 25 mm.

Habitat: Castro, Parana. *Rivula mandane* Druce, of which I possess the type is merely one of the paler forms of *G. partita* Gn.

Palindia hermura, sp. nov.

Body bright yellow, the collar and thorax outlined with white. Primaries above bright yellow; a basal spot on the costa reaching the median vein, a broad and irregular antemedial band, and a spot on the costa at two-thirds from the base all lilacine faintly outlined with black; at the anal angle a white line, shaded with lilacine striæ, extends to vein 5. Some small black apical costal spots; a dark terminal line; the fringe yellow tipped with silvery white. Secondaries whitish yellow shaded with bright yellow below the cell and along the margins; on the outer margin a large spot, white and lilacine shaded with darker striæ. Underneath the wings are pale yellowish white. Expanse, 26 mm.

Habitat: Jalapa, Mexico; Aroa, Venezuela.

Dyomyx volcanica, sp. nov.

Body and wings lightish brown. Primaries with a fine dark velvety basal line from costa to the submedian vein; a large irregular dark velvety brown triangular space from the costa to just above the inner margin, limited by the antemedial and medial lines which are pale; an oval dark spot surrounded by a yellowish line and containing a fine blue point extends from this space to the inner margin; the reniform large irregularly outlined with dark brown; the postmedial line dark, angular, only visible near the costal margin; a subterminal row of dark spots beyond which the outer margin is darker; a terminal dark line preceded by a row of yellowish dots; fringe dark brown. Secondaries with a terminal yellow line; some brown and black scales on the outer margin surmounted by a cluster of bluish scales, above which two yellowish curved lines edged with black extend towards the cell and outer margin; the fringe brown, towards the apex yellowish. Underneath brown with a postmedial dark wavy line, and an antemedial line on the secondaries. Expanse, 43 mm.

Habitat: Orizaba, Mexico.

Dyomyx jonesi, sp. nov.

Body brown. Primaries above with the basal half dark reddish brown, the outer half lighter brown, separated by an oblique transverse line from the middle of the costal margin to the inner margin at two-thirds from the base; this line outwardly shaded with yellowish; just above the inner margin and close to this line a black spot surrounded by an orange line and containing a white dot; a dark basal line from the costa to the median vein; an oblique, dark antemedial line from costa to middle of inner margin; a postmedial line from costa to vein 3, where it is lost in a cluster of grayish scales which extend to the inner margin; the reniform large, outlined in dark brown; a subterminal irregular line of dark sagittate spots outwardly shaded with yellowish; a terminal dark gray line. Secondaries dark brown; a subterminal yellowish line surmounted near the anal angle by white and lilacine scales, above which an irregular yellowish line extends towards the cell and also towards the outer margin; a terminal gray line; the fringe partly yellowish. Underneath the wings are brown with a wavy dark postmedial line, and an antemedial shade on the secondaries. Expanse, 46 mm.

Habitat: Sao Paulo, S. E. Brazil.

Oræsia serpens, sp. nov.

Palpi, head and thorax dark brown. Abdomen light brown, laterally buff. Primaries above dark silky brown, the veins tinged with violaceous; two dark median transverse lines, the outer one the more conspicuous and forming a border to the tooth on the inner margin; a subterminal dark wavy line, not reaching the submedian vein and extending abruptly to the outer margin, forming an angle which encloses a small yellowish spot. Secondaries brown, fringe whitish. Underneath primaries dull brown with the costal margin whitish. Secondaries whitish, the outer margin dull brown, and a dull brown streak at the base of the costal margin; a small brownish discal spot whitish in the center. Expanse, 35 mm.

Habitat: Jalapa, Mexico.

Phrodita bilinea, sp. nov.

Palpi orange. Head, thorax and abdomen creamy white. Primaries above creamy white, the costal margin finely orange; a velvety black streak below the median vein, not quite reaching the outer margin; a black point in the cell followed by a black streak to the outer margin and which is crossed at the end of the cell by a whitish line. Secondaries white. Underneath primaries yellowish white, showing indistinctly the streak on the upper side; secondaries white. Expanse, 33 mm.

Habitat: Castro, Parana.

ON THE LARVÆ OF CERTAIN NEMATINÆ AND BLENNOCAMPINÆ, WITH DESCRIPTION OF NEW SPECIES.

BY HARRISON G. DYAR, PH.D.

Pontania borealis *Marlatt.*

Galls on *Salix sericea* at Plattsburg, N. Y.; solitary, smooth, exceeding the edge of the leaf, reaching from the midrib to beyond the margin and at varying distance from the base; not evenly divided by the leaf about one-third above, two-thirds below; shape pyriform or rounded; a few corky dots; color greenish, strongly red shaded, especially above; length, 8–9 mm., width about 6 mm., height, 5 mm. The substance is thick, fleshy, white with pink lines.

Larva.—Head .6 mm.; all white, eye and mouth black.

Last Stage.—Head whitish, a dusky shade above the clypeus, eye black mouth, brown; width 1.0 mm. Body all white, waxy, not shining, segments obscurely 3-annulate, a little shaded with blackish in the folds. Thoracic feet rather large, colorless; abdominal ones on joints 6 to 11, distinct, slender. Body uniform, subventral folds somewhat prominent, joint 13 tapering. Length, 6.5 mm. Single brooded; cocoons in decayed wood.

Pontania consors *Marlatt.*

Galls found with the preceding on *S. sericea*, but gregarious, hairy and spherical. Near the base of the leaf, three or two together, rarely but one, exceeding the margin often by half the diameter of the gall; not evenly divided by the leaf, about one-third or a little more above, two-thirds below; pale greenish, often heavily marked and mottled with red above, paler below, rarely uniformly pale. Strongly silky hairy like the leaves below, less hairy or even smooth above; size 8.5×8.5×7 mm. or as small as 5 mm. in diameter. The substance is fleshy, strongly streaked with pink.

Larva.—Head .9 mm.; all white, eye and mouth black, segments annulate, with large obscure concolorous tubercles; joint 13 tapering.

Single brooded; cocoon in decayed wood.

Pteronus carpini *Marlatt.*

Gregarious on the iron wood,* Fort Lee, N. J., in September. Head shining black, 1.8 mm. wide, under the lens black dotted on a

* I am not certain now whether this tree was the *Ostrya virginica* or *Carpinus caroliniana.*

sordid ground, mouth brownish. Feet on joints 6–11; no glands everted. Segments coarsely 4-annulate with small dark setæ. Color dull green, the spiracles with faintly discolored yellow blotches; dorsal region shaded with black, the color streaked on the annulets, not forming a distinct regular edge and not complete, tending to be broken into dorsal and subdorsal bands. Subventral folds double. A spot below the spiracle and one above the base of the leg, black. Thoracic feet and venter pale. Imago in May. The species is probably double brooded. The larva looks like that of *Pteronus corylus*.

Pteronus integer *Say*.

Dr. Packard describes a larva on spruce (5th Rept. U. S. Ent. Comm., p. 838) as of this species. It is green with a dusky supra-ocellar shade, the dorsal vessel edged with light green and a white lateral stripe. The number of feet is not given.

I think there is some error here and that this larva is not that of *integer*. The true larva is described herewith.

Stage V.—Head sordid greenish with a heavy brown-black shade reaching up each side behind the eye, a dotted shade on vertex, the sutures pale; width 1.6 mm. (♀). Body green like *Nematus chloreus* not very sordid nor very transparent; black marks at the base of the thoracic feet. Segments irregularly 6-annulate in this large larva, bringing the spiracle on third annulet, 5-annulate in another with spiracle placed normally. No other marks. Anal plate concave-truncate as in *N. chloreus*. The larva is throughout closely allied to *chloreus* and differs only in having the head marked with dark shades in the last stage. Tracheal line visible.

Single brooded, no ultimate stage; cocoon as usual in the earth.

Found on *Quercus tinctoria* at Brookhaven, Long Island; not common, the rarest of the oak feeding Nematids

Pteronus quercus *Marlatt*.

Solitary on white oak (*Q. alba*) resting on the edge of the leaf.

Stage IV.—Head round, eye black, a very faint posterior dark shade; width .9 mm.; whitish, sordid with scarcely any ochreous tint. Body colorless, translucent, appearing sordid from the food by transparency, the incisures folded; segments obscurely 4-annulate, smooth; anal plate concave-truncate, no prongs. A large black spot at the base of the colorless thoracic feet; abdominal ones on joints 6–11. Tracheæ white.

Stage V.—Head 1.3–1.5 mm. (♂ ♀) colorless, faintly yellowish,

eye black; a distinct shaded black line posteriorly from behind the ocellus to vertex. Body sordid greenish, annulets dull, incisures folded. Anal plate and marks at base of thoracic feet as before. Tracheæ and folds of incisures white.

Single brooded; cocoon in the ground.

This larva closely resembles *Nematus chloreus* but is not so green and has a black shade on the head in the last stage. Brookhaven, Long Island, in June.

Nematus chloreus *Norton.*

On the black oak (*Q. coccinea*) at Bellport, Long Island, in June, a solitary edge-eating Nematid.

Egg slits in the edge of the leaf just before the point of the apex, 1 mm. long,.5 mm. deep, semi-circular, swollen, yellowish.

Stage I.—Head sordid whitish, eye black, a dusky shade behind and over clypeus; width .4 mm. Body whitish translucent, green from the food, smooth, slender, curved, annulate; feet on joints 6–11; a ventral elevation on joint 5; no setæ. Black marks at the base of thoracic feet.

Stage II.—Head whitish, dull, eye black, the vertical shade behind it reaching nearly to apex; width .6 mm. Body rather finely annulate, whitish, green only from the food, bases of thoracic feet marked with black. Anal plate truncate, concave, the posterior rim dusky bordered.

Stage III.—Head rounded, whitish, eye black, a dark shade behind; width .8 mm. Body translucent sordid greenish, no marks except at bases of thoracic feet; spiracles blackish.

Stage IV.—As before, the dusky shade behind the eye has become small; width 1.15 mm. Anal plate projecting, truncate-concave; no prongs. Translucent whitish green with black marks at base of thoracic feet.

Stage V.—Head green, eye black, mouth brown, no marks; width 1.4–1.6 mm. (♂ ♀) clearer green than before, incisures folded; black marks at bases of thoracic feet clouded, small. Anal plate truncate, slightly cordately notched, no prongs. A little green fat in joint 13, the frass not contrasted; dorsal vessel obscure. Head shagreened, dull; body also dull. Thoracic feet colorless, abdominal ones small, slender on joints 6–11 and 13, functional. Segments irregularly wrinkly 6-annulate, last annulet very narrow, the others subequal; no setæ even under a ½-inch objective. Sometimes the body is faintly yellowish subdorsally from the obscure fat granules; spiracles dusky.

Cocoon elliptical dark brown, single, formed at the surface of the ground. Single brooded. This is the commonest of the oak feeding nematids on Long Island, N. Y.

Hemichroa fraternalis *Norton.*

♂ described by Norton (Trans. Am. Ent. Soc., IV, 81).

♀ black and rufous. Head black; prothorax pale, whitish, interior lobe of mesothorax and upper half of pleura shaded with brown; abdomen largely pale brown. All the segments above broadly banded with black and narrowly so below. Legs luteous, femora and tibia lined with black. Wings hyaline, nervures black, costa and stigma luteous. Length, 9 mm. Texas, New York, Massachusetts. A perfectly distinct species, not nearly allied to *H. albidovariata*. The larva lives on the young leaves of the white oak in May and early June, solitary. Each larva eats away the leaf from the midrib or a large vein and uses the vein as a perch somewhat in the manner of the young *Liminitis* They hold on by the thoracic feet and thresh the body around violently when disturbed. There are probably five larval stages.

Stage I.—Head rounded, dull, dusky, eye black; width .4 mm. Body annulate, sordid grayish green, uniform with short black points. A dark line at base of thoracic feet.

Stage II.—Head .6 mm., sordid whitish, gray posteriorly, eye black; body slate gray, whitish below the spiracles.

Stage III.—Head small, leaden black, width .9 mm. Segments 6-annulate, with black points on the second and fourth. Body slate gray, more or less whitish subventrally below the spiracles, a dusky shade along subventral folds. Thoracic feet largely black, abdominal ones small, on joints 6–12, 13. Venter waxy grayish white.

Stage IV.—Head sordid leaden, clypeus and back of head nearly black; antennæ and eye black; width 1.3 mm. Dorsum leaden black, somewhat broadly greenish centrally except in the incisures, below the spiracles nearly white, the subventral folds marked in blackish, forming a double row of dashes. Thoracic feet largely black, abdominal ones pale. Black points on second and fourth annulets small. Later the larva becomes more greenish with growth.

Stage V.—Head black, the face pale and vertex gray; or a light fleshy brown; width 1.6–1.8 mm. (♂ ♀). Body sordid greenish gray, white subventrally, a lateral leaden gray shade band touching the stigmatal line; dusky marks on the subventral folds; points small, black. Thoracic feet pale, black at base; a trace of white bloom on head. In some the subventral region is scarcely contrasted and the larva appears

more uniformly gray. The black points vary in distinctness, sometimes obsolete. Occasionally the larva is very pale, an albino, with dull red head and sordid white body marked with an olivaceous blackish lateral band.

No ultimate stage; cocoon dark brown, formed in the earth. Single brooded.

Larva referred to as "F" Can. Ent. XXVII, 339.

Hemichroa albidovariata *Norton.*

♀ described by Norton (Trans. Am. Ent. Soc. IV, 81).

♂ closely similar to ♀ with the three basal segments of abdomen above yellowish white, the basal plates black. Two ♀♀, one ♂ from Texas (Belfrage), coll. U. S. Nat. Mus., one ♀ from larva at Bellport, Long Island, N. Y. The larvæ live on the black oak (*Q. coccinea*) in May, eating the young leaves, resting on the edge, the abdomen slightly curled.

Stage V.—Head pale red-brown, eye narrowly black, mouth dark brown; width 1.8 mm. (♀). Feet on joints 6–12, 13, moderate; segments regularly and distinctly 6-annulate, spiracle on second annulet. Color translucent fleshy brown, a lateral row of irregular black spots on annulets 1 (small), 2–3 (large), 4–5 (rather small), the large one broken on some segments; all absent on joint 13; anal plate immaculate. Some small black marks around spiracle; a distinct black patch on the anterior subventral fold and a smaller patch on the posterior one. Feet and venter unspotted, but a black mark at the base of thoracic feet. Dorsal vessel and paired dots on annulet 1 dusky translucent.

No ultimate stage; cocoon in the ground; single brooded.

Hemichroa phytophagica, sp. nov.

♀ extremely similar to *H. albidovariata* but the pale lines on anterior lobe of thorax are short and obscure and the basal plates of abdomen are black.

One ♀ bred from larva from Bronx Park, New York, and two ♀♀ in coll. U. S. Nat. Mus. marked "saw fly on white oak" from Miss Murtfeldt, No. 241 M., Dept. Agriculture, No. 3168.

Found on the young leaves of the white oak in May.

In Bronx Park these larvæ were mixed with those of *H. fraternalis*, and showed somewhat the same habits by eating away the leaf from the midrib; but they do not use this as a perch and are true edge eaters.

Stage I.—Head rounded shining black-brown; width .4 mm.

Body lustreless blackish, segments 6-annulate with rows of short, blunt, pale points on second and fourth annulets, about six on each side.

Tracheal line pale; feet on joints 6–12, 13. Eats the whole leaf on the edge.

Stage II.—Head pale, faintly brownish, eye black with a very faint dark shade reaching upward. Body whitish translucent, colored by the food, the points blunt, fleshy, dark at tip.

Stage III.—Head very pale brownish, eye narrowly black. Body translucent waxy whitish, segments 6-annulate, the points whitish; no marks. Incisures folded,tracheal line white.

Stage IV.—Head pale brown, eye black. Body moderately translucent, dull whitish with a tinge of yellowish and green, the folds of skin whiter. Points obsolete; no marks or, in some, a small black patch laterally on third annulet and another on anterior subventral fold, more or less distinct. In some the points are still visible, pale, rarely distinctly defined by dusky dots. Spiracle on the second annulet.

Stage V.—Head pale, finely brown dotted, eye black. Segments 6-annulate, smooth, no points seen. Skin thin, the body uniformly green from the blood, dorsal vessel dark, outlined by a little green fat, not contrasting strongly. A black patch on the anterior subventral fold and sometimes another laterally. Tracheæ evident, their ramifications visible nearly up to the dorsal vessel. Thoracic feet pale; anal flap smooth. Abdominal feet on joints 6–12, 13. The larva is now very green, differing markedly from the preceding stages. A single example from Bellport, Long Island, had a black dot on the thorax, subdorsally on the second annulet of joints 2 and 3, one on the anterior subventral fold of joint 3 and one at base of each thoracic foot. The paired dusky translucent patches in annulet 1 were also noted. No ultimate stage; cocoon in the ground; single brooded. This larva is possibly a dimorphic form of *H. albido variata*, but the food plants differ and the slight imaginal characters seem correlated.

GENERIC SYNOPSIS OF THE BLENNOCAMPINÆ.

The following tables have been prepared by Mr. Ashmead for his forthcoming revision of the genera of saw flies and he has kindly given me a copy of them for use here.

Family SELANDRIIDÆ.

TABLE OF SUBFAMILIES.

Lanceolate cell petiolate; (in only a single genus, *Kaliosysphinga*, does it appear contracted, but the anal vein is faint or subobsolete before uniting with the submedian vein, while the anal cell in hind wings is wanting).
Subfamily I. *Blennocampinæ*

Lanceolate cell contracted before the middle but still open.
Antennæ 4-jointed, the third joint very long, the fourth very minute.
Subfamily II. *Blasticotominæ*
Antennæ 7 to 15-jointed, the third joint not unusually long, often shorter or not longer than the fourth.........................Subfamily III *Selandriinæ*

Lanceolate cell contracted at or at little before the middle and completely closed.
Subfamily IV. *Hoplocampinæ*

Subfamily I. BLENNOCAMPINÆ.

TABLE OF GENERA.

1. Front wings with four submarginal cells.................................. 3
Front wings with three submarginal cells, the first transverse cubitus wanting, very rarely with the second transverse cubitus wanting.
Hind wings with two discal cells.....................................2
Hind wings without discal cells.
Antennæ 11–14 jointed..........................**Fenella** *Westw.*
Antennæ 9-jointed.
Hind wings with a distinct anal cell............**Fenusa** *Leach.*
Hind wings without an anal cell.......**Kaliosysphinga** *Taschb.*

2. Head transverse; clypeus anteriorly truncate; front wing with the second transverse cubitus wanting............................**Palmatopus** *Hartig.*
Head large, quadrate, the temples broad; clypeus anteriorly deeply emarginate; antennæ densely hairy, the third joint nearly as long as joints 4–5 united.
Xenopates *Cameron.*

3. Eyes extending to base of mandibles or at most with only a linear space between. 7
Eyes more or less distant from base of mandibles, with a distinct space between.
Hind wings not surrounded by a bordering nervure at apex...... 4
Hind wings surrounded by a bordering nervure at apex, and without a discal cell; claws bifid or with a tooth within.
Anal cell in hind wings shorter than the submedian, petiolate or subpetiolate at apex. ♂ ....* **Periclista** *Konow.*
(= *Mogerus* Mac G.)
Anal cell in hind wings fully as long as the submedian. ♂
Isodyctium *Ashm.* g. n.
(Type *caryicolum* Dyar.)

* Mr. MacGillivray was not justified in changing the name of this genus, since the cynipid genus is *Periclistus*, not *Periclista*.

4. Hind wings without a closed discal cell....................................6
Hind wings with a closed discal cell.
Claws simple or with a minute scarcely perceptible tooth within. 5
Claws cleft or with a large tooth within.
Anal cell in hind wings as long as the submedian. ♀
Isodyctium *Ashm.*
Anal cell in hind wings shorter than the submedian.
Transverse median nervure in hind wings received by the discal cell at or somewhat *beyond* the middle; sheaths of ovipositor equally thickened and more or less obliquely pointed at apex; third joint of antennæ almost as long as joints 4–5 united. ♀
Periclista *Konow.*
Transverse median nervure in hind wings received by the discal cell *before* the middle; sheaths of ovipositor produced at apex into a thorn like tip. ♀.................... **Ardis** *Konow.*
5. Third joint of antennæ longer than the fourth; sheaths of ovipositor at tips obtuse.
Pareophora *Konow.*
Third joint of antennæ a little shorter than the fourth, never longer; sheaths of ovipositor at tips rounded; clypeus anteriorly truncate. **Rhadinoceræa** *Konow.*
6. Anal cell in hind wings as long as the submedian. ♀. .... **Isodyctium** *Ashm.*
Anal cell in hind wings shorter than the submedian. ♂ ....**Ardis** *Konow.*
7. Third joint of antennæ longer than the fourth. 8
Third joint of antennæ shorter than the fourth or not longer; hind wings with one discal cell; claws bifid...................... **Phylmatocera** *Dahm.*
8. Præsternum of mesosternum not at all separated by a suture.................9
Præsternum of mesosternum separated by a distinct suture.
Clypeus anteriorly truncate; hind wings with one discal cell, the anal cell shorter than the submedian; claws long, simple.. **Tomostethus** *Thms.*
9. Hind wings with one discal cell...13
Hind wings without a discal cell.
Hind wings with the marginal cell pointed at apex and sometimes open..12
Hind wings without a surrounding nervure at apex the marginal cell well rounded at apex and *with* an appendage..........................10
Hind wings with a surrounding nervure at apex the marginal cell well rounded at apex but *without* an appendage................ 11
10. Third transverse cubitus curved inwardly and not extending in the same direction with the transverse radius, the third submarginal cell considerably larger than the first and second united; antennæ densely pilose, tapering toward tips, the third joint longer than the fourth; claws cleft. ♀ ♂. **Parazarca** *Ashm.* g. n.
(Type *fumipennis* Ashm.)
Third transverse cubitus straight or nearly so, and running in the same direction with the transverse radius; antennæ pubescent, the third joint nearly as long as joints 4 and 5 united
Claws cleft or bifid; anal vein in front wings straight, not curving upwards at tip; transverse cubitus in hind wings not short, the anal cell shorter than the submedian, briefly petiolated... ♀ **Erythraspides** *Ashm.* g. n.
(Type *pygmæa* Say.)

Claws simple; anal vein in front wings curving upwards at tip; transverse cubitus in hind wings very short, the anal cell longly petiolated. ♀ ♂.
Blennocampa *Hartig.*

11. Third transverse cubitus curved inwardly, not extending in the same direction with the transverse radius, strongly divergent; third submarginal cell larger than the first and second united; pedicel as long as the scape, about thrice as thick. ♂ .... **Calozarca** *Ashm.* g. n.
(Type *fascipennis* Nort.)

Third transverse cubitus straight or nearly so, and running in the same direction with the transverse radius; third submarginal cell hardly longer than the second, much smaller than the first and second united; pedicel shorter than the scape. ♂. .... **Erythraspides** *Ashm.*

12. Third transverse cubitus in front wings not running in the same direction with the transverse radius; marginal cell in hind wings *with* an appendage; third joint of antennæ much shorter than joints 4–5 united; claws with a small tooth within .... **Scolioneura** *Konow.*

Third transverse cubitus in front wings almost interstitial with the transverse radius, and running in the same direction; marginal cell in hind wings without an appendage, sometimes open at apex; claws with a strong triangular tooth at base.. **Entodecta** *Konow.*

13. Hind tarsi usually longer than their tibiæ; clypeus very small, transverse-linear. antennæ densely pilose, the third joint longer than the fourth. ♀ ♂.
Zarca *Cameron.*

Hind tarsi not longer than their tibiæ; clypeus not small, anteriorly subemarginate or truncate.

Antennæ pubescent, the third joint distinctly longer than either the fourth or the fifth.

Third submarginal cell longer than the first and second united; antennæ long, tapering toward tips, the third joint about as long as joints 6–9 united ♀ .... **Calozarca** *Ashm.*

Third submarginal cell not longer than the first and second united; antennæ with the third joint usually not longer than joints 9–10 united .... **Monophadnus** *Hartig.*

Antennæ clothed with long appressed hairs, the third and fourth joints equal, the fifth longer, all somewhat thickened toward tips.. **Senoclia** *Cameron.*

Periclista diluta *Cresson.*

These larvæ are briefly described from Riley's notes in Packard's Forest Insects (5th Rept. U. S. Ent. Comm., p. 206), but without giving the most essential characters. The bred flies in collection U. S. Nat. Mus., have the lanceolate cell of hind wings unusually long, though still shortly petiolate at tip.

Periclista purpuridorsum, sp. nov.

♂. Black, segments 2 to 4 of tergum dull luteous; angles of prothorax (except a black dot) and tegulæ white; tip of clypeus and labrum pale. Legs black at base, ends of femora and tibiæ whitish and brown, tarsi dusky, nervures brown black; second recurrent received at base of third submarginal cell, almost interstitial.

♀. Reddish brown and black. Head black, tip of clypeus and labrum pale brown. Thorax brown, a black spot on each lobe, lower half of pleura and pectus black; prothorax and tegulæ whitish. Abdomen brown, shaded with black on each segment, the basal four segments solidly black; ovipositor sheath black; all the segments above and below narrowly lined with whitish posteriorly. Legs reddish, coxæ black, tibiæ whitish and tarsi dusky. Middle cells of hind wings one or none. The larva resembles that of *P. diluta* as far as that description goes.

Stage III.—Head black, a pale dot at apex of clypeus; width .6 mm. Body green, food darker, the four dorsal spines on each side black with white limbs.

Stage V.—Head pale in sutures and face, all the black marks touching each other; width, 1 mm. Body green, dorsum faintly shaded with purplish; spines as before, all distinctly furcate.

Stage VI.—Head pale, the lobes broadly black and a geminate spot in clypeus; width, 1.4 mm. Segments indistinctly 5-annulate, two spines on second (spiracular) annulet, one small one on third behind spiracle, three on fourth; two on each subventral fold. Legs on joints 6–12, 13; rest on venter on surface of leaf. Dorsum to spiracles olivaceous blackish, the four dorsal spines black, short with short limbs or reduced to small black buttons; joint 2 anteriorly, subventral region and feet pale greenish white with colorless furcate spines which fringe the sides. The dorsal spines on joints 2, 3, 12 and 13 are not reduced. At the end of the stage the dorsal color fades to purplish.

Stage VII.—(Ultimate.) Smooth, no spines, annulets folded; shining areas represent the tubercles; color translucent waxy greenish white, greener on the thorax, often blue-green; no purple shade. The larvæ enter the earth and form cells lined with brown secretion. Solitary on the white oak in May, eating the young leaves; single brooded. Found at Pelham Manor and Bellport, Long Island, N. Y., Washington, D. C.

Periclista albicollis *Norton.*

Stage IV.—As in next stage; head .7 mm.

Stage V.—Head shining black except mouth and a small arcuate line above clypeus which are greenish; width, 1.1 mm. Spines arranged as in the preceding species, quite large and strongly furcate, all black, even the little one on third annulet and the anterior one of the upper subventral fold; lower subventral spines pale, not furcate. Body translucent green, indistinctly annulate. Feet on joints 6–12, 13.

Stage VI.—Head 1.4 mm. The same, the spines with long tapering limbs, longer than the shaft.

Stage VII.—(Ultimate.) Not smooth, the tubercles represented by small distinct cones; not shining, all very light whitish green, very much whiter than in the feeding stages, slightly wrinkly annulate, no marks, no tarry shades. Larva as high as wide, robust. Spins a rather fine brown cocoon either in the earth or after boring in decayed wood. Single brooded. The larva is solitary, rarely several together, resting on the upper side of the leaves of *Q. tinctoria* early in June. They are unusually sluggish, often feeding upon a single leaf.

Others were found on the white oak (*Q. alba*) which appeared less robust and had a pale space on the spines at the bases of the limbs; but the imagines seem indistinguishable from the others.

Brookhaven, Bellport and Yaphank, Long Island, N. Y.

Periclista emarginata *MacGillivray.*

♀. Black, clypeus emarginate, labrum pale; abdomen with the tips of segments lined with whitish below, the last segment brownish; prothorax largely and tegulæ white; legs pale, the femora brown, except narrowly on the under side; tips of tarsi dusky. Under wings with one middle cell or none.

Two ♀♀ bred from larvæ similar to those described (Can. Ent., xxvi, 185), which produced the ♂ type.

Stage IV.—As in next stage, spines all pale; head .7 mm.

Stage V.—Head 1.1 mm., a shade above ocelli, the patch in clypeus single, transverse, later double.

Body green, spines all pale, furcate, arranged as in the preceding species of *Periclista.*

Stages VI and *VII* have been published.

Found on *Q. coccinea* at Pelham Manor and Van Cortlandt Park, N. Y., in May.

Periclista subtruncata, sp. nov.

♀. Similar to the preceding, but the clypeus shallowly emarginate. Shining black, prothorax narrowly and tegulæ white; abdomen entirely black. Legs brown, coxæ and basal two-thirds of femora blackish, tarsi dusky. Sculpturing essentially as in *emarginata,* but the vertical groove on head shows a tendency to cross the transverse one between the posterior ocelli. Length, 5.5 mm. One ♀.

Not strikingly distinct in either imago or larva from *P. emarginata,* but both Mr. MacGillivray and Mr. Ashmead have compared the flies and do not consider them the same.

Stage IV.—Head pale brown, dotted on a greenish ground, a black

patch in clypeus; eye and antennæ black. Body light yellowish green, the furcate spines paler except the thoracic ones which are black tipped. Feet on joints 6–12, 13, the thoracic ones short, scarcely visible from above.

Stage V.—Patch in clypeus brown; body green, dorsal vessel less contrasting.

Stage VI.—Head green, clypeus brownish, eye black. Body rather opaque green, a little whitish dorsally from diffuse fat, dorsal vessel darker green. Furcate spines whitish, dusky tipped on joints 2 and 3 and faintly on anal flap.

Stage VII.—(Ultimate.) Smooth, waxy greenish, eye black; shining, indistinctly annulate, dorsal vessel green. Cocoon in the ground; single brooded.

Found on the black oak (*Q. coccinea*) in Van Cortlandt Park, N. Y., in May.

Periclista chionanthi *Murtfeldt*, (M.S.).

♀. Shining black; tips of femora and tibiæ dull luteous, tarsi dusky; angles of prothorax narrowly and tegulæ whitish. Wings hyaline, nervures brown-black; second recurrent nervure received at basal third of third submarginal cell. One middle cell in hind wings. Length, 5.5 mm.

Two ♀♀, Coll. U. S. Nat. Mus. (Miss Murtfeldt), no. 296 M.

Larva.—Head shining black, mouth parts only pale. Segments indistinctly 5-annulate, spines furcate, moderate, two on second (spiracular) annulet, three on fourth, two on each subventral fold, all furcate except the pair on lower subventral fold. Body yellowish with numerous fat granules, a broken subdorsal black shade, distinct at the bases of the second spines. Dorsal spines black-ringed at base. Thoracic feet small, abdominal moderate on joints 6–12, 13; rests on venter on surface of leaf. "Slug on white fringe" (*Chionanthus*), Kirkwood, Mo., Dept. Agriculture no. 4048 bis.

Periclista media *Norton.*

Sitting on the venter on the surface of young leaves of white oak (*Q. alba*), eating circular holes, solitary.

Stage I.—Head very pale brown, eye black; width .3 mm. Body translucent whitish, food brownish; covered with short colorless Y-shaped spines, thick and with short shaft, the limbs blunt, apparently arranged as in the later stages.

Stage II.—Head and body translucent, colorless, eye black; width .4 mm. Spines with long shaft and sharp recurved branches extending

in a longitudinal plane. Segments scarcely annulate. Thoracic feet large, abdominal on joints 6–12, 13.

Stage III.—Waxy white, shining, eye black; width .6 mm. Body pale green, principally from the food. Furcate spines moderate, concolorous whitish. Feet pale. Length, 5.5 mm.

Stage IV.—The same. Head .8 mm., length, 6 mm. The body becomes darker green from the food, but the blood is pale green, tinting the subventral area.

Stage V.—The same; width of head 1.1 mm.

Stage VI.—Entirely green, no marks. Furcate spines rather short; seeming remote, none dark; arrangement as usual in *Periclista* with but two spines on the spiracular annulet. Head greenish white, eye black; width 1.4 mm. Rarely some of the spines are trifid instead of bifid. A variety occurs with a black patch in the clypeus, but it disappears in the last stage, leaving the larva immaculate. Segments indistinctly annulate.

Stage VII.—(Ultimate.) Smooth, all greenish, not shining; head and thorax emerald tinted; dorsal vessel green. Enter the earth and form cells. Single brooded, common on the white oak in May, the commonest of the early spring slugs. Van Cortlandt Park, Bronx Park, Bedford Park, Pelham Manor, N. Y.; Fort Lee, N. J., Brookhaven, Bellport and Yaphank, Long Island.

KEY TO THE AMERICAN SPECIES OF *Periclista*, ♀.

1. Yellow with brown thorax; no black above.................... **diluta** *Cress.*
   Prevailing color black.. 2
2. Black of dorsum mixed with brown, abdominal segments very narrowly white bordered.................................... **purpuridorsum** *Dyar.*
   Entirely black above.. 3
3. Clypeus somewhat angularly emarginate.................................. 4
   Clypeus more broadly and shallowly emarginate or truncate.................. 5
4. Slender, legs whitish and amber brown; vertical groove from lower ocellar basin distinct.................................. **emarginatus** *Mac G.*
   Robust, legs shading to black on femora; vertical groove from lower ocellar basin short.. **albicollis** *Nort.*
5. Clypeus shallowly emarginate.. 6
   Clypeus truncate, scarcely at all emarginate.............................. 7
6. Legs heavily shaded with blackish brown; transverse groove between upper ocelli straight, slightly crossed by the vertical groove.......... **subtruncata** *Dyar.*
   Legs mostly whitish below the femora; transverse groove slightly bent at junction with vertical one, not crossed by it .... **chionanthi** *Murtf.*
7. Legs pale, femora brownish, abdomen brownish at sides posteriorly; vertical groove short, the lower ocellar basin reaching nearly to the transverse groove. **media** *Nort.*

Isodyctium floridense, sp. nov.

♀. Brown; antennæ, except basal joint, black. Head narrowly darker brown in the sutures, orbits yellowish. Thoracic lobes lined with yellowish as in *rileyi*, but without black, only darker brown double marks on the side lobes. Abdomen brown, basal plates yellowish, lined before and behind narrowly with blackish; beneath shaded with black, especially towards tip. Mesopleura brown, with a yellow line posteriorly. Legs pale. Wings hyaline, veins blackish brown, basal half of stigma pale. Length, 6.5 mm.

One ♀. Florida, U. S. Nat. Mus. (from Am. Ent. Soc.).

Larva unknown.

Isodyctium subgregarium, sp. nov.

♂. Head black, clypeus emarginate with two white dots at tip, labrum pale; clypeus hollowed below each antennæ, the lower rim projecting. Thorax black, tegulæ and collar (except a black dot) white; a line on mesopleura and sutures below white. Abdomen whitish, basal plates and four terminal segments above black, below shaded with black. Legs pale, tarsi shaded with blackish, coxæ and trochanters spotted with black. Wings hyaline, costa pale at base, second recurrent nervure received near base of third submarginal cell. Length, 6 mm.

♀. Pale yellowish, head, thorax and pleura red Antennæ black except basal joint; narrow black linings in head grooves and in sutures behind mesothorax. Legs yellowish, tarsi slightly tipped with blackish. Wings hyaline, nervures pale, those toward center of wing lined with black. No middle cells in hind wings. Length, 6.5 mm.

Stage IV.—Head green with a large triangular black patch on each lobe and one in clypeus; width .8 mm. Spines furcate, short, three on second and fourth annulets, one behind spiracle, two on each subventral fold, the smaller ones simple. Spines black except the subventral ones; feet pale, abdominal ones on joints 6–12, 13.

Stage V.—The same; patch in clypeus double; width of head 1.2 mm. Spines distinct, the limbs curving, divergent and tapering.

Stage VI.—Head 1.8 mm. Body uniformly green from food, spines black except on lower subventral fold. No change in coloration.

Stage VII.—(Ultimate.) Smooth, entirely green, eye black; shining areas in the places of the spines. Enter the earth and form cells; single brooded.

The larvæ are gregarious in the early stages, but separate before maturity.

Found in May on white oaks (*Q. alba*, *Q. prinus*) at Pelham Manor, Bronx Park and at several places on Long Island.

Isodyctium infrequens, sp. nov.

♀. Robust; head black, a brown dot between antennæ and line at tip of clypeus which is scarcely emarginate. Thorax dark brown, streaked with black on all the

lobes, scutellum black; pleura brown above, black below, pilose. Abdomen brown, segments banded with blackish posteriorly, more distinctly toward base above. Legs brown, tibiæ and tarsi paler. Wings hyaline, costa and stigma pale. One middle cell in hind wings. Length, 6.5 mm.

Stage V.—Head immaculate, eye black; width, 1.1 mm. Body green, dorsal vessel darker; spines moderate, furcate, arranged as is normal for *Isodyctium* with three on spiracular annulet, pale except the terminal ones on joints 2, 3, 12 and 13 which have black limbs and the upper row the whole length which is touched with black at the base of the fork, leaving the apex and shaft pale. Feet pale, 6–12, 13.

Stage VI.—Head 1.6 mm., green, eye narrowly black. Body faintly annulate, spines all pale except the black patches as before. Another had the limbs of the four dorsal spines black whole length.

Stage VII.—(Ultimate.) Head slightly brownish tinted, eye black; width 1.6 mm. Body smooth, green, with shining areas instead of the spines, indistinctly annulate. Color uniform, dorsal vessel dark.

Single brooded, cells in the ground as usual.

Found on the white oak (*Q. alba*) at Brookhaven and Bellport, Long Island, early in June, but probably occurs earlier in the mainland where the season is not retarded by cold winds as on the south shore of the island. Rare.

Isodyctium murtfeldtiæ, sp. nov.

♀. Head black, clypeus emarginate, its tip and labrum whitish. Thorax brown, a black spot on each lobe; metathorax black. Mesopleura brown above, black below, a distinct white line behind; metapleura shining black, lined through the middle with white. Abdomen mostly pale luteous, basal plates and irregular marks on some of the sutures black. Legs pale, black marks only in sutures of trochanters and coxæ. Hind wings with one middle cell. Length, 5 5 mm.

One ♀, Miss Murtfeldt, no. 207 M.

Larva.—Head green, eye narrowly black; width, 1.4 mm. Body green, the spines distinct, well furcate (arrangement not discernible in the specimen, but presumably as in *Isodyctium*), all the basal ones broadly black at the base and with blackish limbs. Food plant, black oak.

Isodyctium calricolum *Dyar.*

In the larvæ previously described (Journ. N. Y. Ent. Soc., V, 193) only the upper spine on second annulet and upper two on fourth were furcate, the rest being reduced to single spines or cones. I have since found others with the spines nearly normally furcate and others perfectly normal, all the spines furcate except the stigmatal one of third annulet,

the posterior one of anterior subventral fold and pair on posterior fold. On acquiring the last stage (VI) some of the lower spines become single.

Stages IV to VII observed. Rather common on the hickory at Bronx Park and Bedford Park, New York, in May.

The ♂ of *I. bipartitum* Cress. closely resembles this species in coloration, but the head sculpturing and shape of clypeus seem different. The ♀ is unknown, and may turn out to be quite distinct from that of *I. caryicolum*.

KEY TO THE SPECIES OF *Isodyctium*, ♀ *.

1. Head in part, at least orbits above pale....................................2
   Head black...5
2. Black on head confined narrowly to sutures.................................3
   Black on head covering most of vertex besides sutures......................4
3. Lobes of thorax yellow lined; orbits narrowly yellowish...... **floridense** *Dyar.*
   Thorax and head uniformly red brown except for slight black marks. **subgregarium** *Dyar.*
4. Lobes of thorax yellow lined, orbits pale above, black before and behind. **rileyi** *Cress.*
5. Upper half of pleura red or brown...6
   Pleura black..9
6. Slender; ocellar basin narrowed, the vertical groove joining the transverse one between upper ocelli...7
   More robust; ocellar basin, triangular, the vertical and transverse grooves slightly crossing...8
7. Middle lobe of thorax brown............................ **inaequidens** *Nort.*
   Thorax heavily black marked on all lobes................ **murtfeldtiae** *Dyar.*
8. Thorax dark brown, the streaks on lobes obscure, brown; abdomen brown at sides.. **infrequens** *Dyar.*
   Thorax brown, obscure streaks black; abdomen yellow at the sides..........9
9. Rather slender, ocellar basin narrow, joining the straight transverse groove above.. **caryicolum** *Dyar.*

SYNOPSIS OF THE LARVÆ OF THE NORTH AMERICAN BLENNOCAMPINÆ SO FAR AS KNOWN.

The Blennocampinæ have feet on joints 6–12 and 13, resting flatly on the surface of the leaf; body thick and robust, as high as wide or more so, except in leaf mining forms which are flattened and have degenerate feet.

The group is rather heterogeneous in appearance, but includes all the leaf miners, all the spiny slugs and the smooth slugs that are thick and robust.

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* *bipartitum* Cress. not included from lack of ♀ specimen.

The hairy, slimy, long-woolly or slender slugs and all edge feeders are foreign to the group.

1. Resting flatly on surface of leaf, feet moderately developed, functional.........2
   Leaf miners, feet functionless or absent................................16
2. Body with spines or points, distinguishable at least subventrally...............3
   Body smooooth..15
3. Two spines on second (spiracular) annulet.................................4
   Three spines on both second and fourth annulets..........................9
4. Dorsum shaded with blackish in last stage, at least subdorsally...............5
   Dorsum entirely green...6
5. Head black spotted; dorsum purplish, on *Quercus alba*. **Periclista purpuridorsum**
   Similar to the preceding...............................**Periclista diluta***
   Head black; a subdorsal black line, on *Chionanthus*..**Periclista chionanthi**
6. Head and spines black; on *Q. alba*, *Q. tinctoria*.......**Periclista albicollis**
   Head and spines partly or wholly green.................................7
7. Head with a black supra-ocellar shade and double spot in clypeus; on *Q. coccinea*. **Periclista emarginata**
   Head green or with only a brownish spot in clypeus........................8
8. Clypeus brownish; terminal spines dusky on the tips; on *Q. coccinea*. **Periclista subtruncata**
   All green, at least in last stage; on *Q. alba*........... **Periclista media**
9. Feeding on trees (*Quercus*, *Carpinus*, *Carya*).........................10
   Feeding on shrubs or vines (*Rubus*, *Vitis*, *Spiræa*).....................13
10. Head largely black spotted, spines black; on *Q. prinus*, *Q. alba* **Isodyctium subgregarium**
    Head not spotted, spines mostly pale...................................11
11. Spines well forked, not degenerate......................................12
    Spines more or less degenerate in last stage; on hickory (*Carya*) **Isodyctium caryicolum**
12. Spines black at base and tip; on *Q. coccinea* .... **Isodyctium murtfeldtiæ**
    Terminal spines only black tipped; on *Q. alba* ... **Isodyctium infrequens**
13. Spines well forked, dorsal ones with black limbs; on raspberry (*Rubus*) **Monophadnus rubi**
    Spines reduced to points..14
14. Head and dorsal points black; on grape (*Vitis*)....**Erythraspides pygmæa**
    All green, points white; on meadow sweet (*Spiræa*)...**Blennocampa spiræ**
15. Head black, body white and yellow; on ash (*Fraxinus*) **Monophadnus barda**
16. Mining in oak (*Quercus*) .... **Fenusa curta**
    Mining in raspberry (*Rubus*)............................. **Fenusa rubi**
    Mining in alder (*Alnus*) .... **Kaliosysphinga varipes**
    Mining in poplar (*Populus*)......................... **Entodecta populi**

NOTE.—Mr. Ashmead has kindly revised the generic references of

* Insufficiently described.

the insects recorded in the above table in accordance with his generic synopsis.

I have excluded the woolly slugs from this table because *juglandis* is clearly referable to the Selandriinæ. There is probably some error connected with the account of the other woolly slug, *Monaphadnus caryæ* of Norton and Packard, and it will be found to be wrongly referred to *Monophadnus*.

NEW SPECIES OF HETEROCERA FROM TROPICAL AMERICA.

By WILLIAM SCHAUS.

SYNTOMIDÆ.

Cosmosoma dorsimacula, sp. nov.

Head and palpi black. Legs brown; fore coxæ white. Collar and thorax orange, the latter with two large black subdorsal spots; a minute black point anteriorly on patagiæ. Abdomen orange with four subdorsal black spots; the last three segments entirely black. Wings hyaline, the margins black, the outer margins and apices more widely so; a large black spot at the end of the cell on the primaries. Expanse, 37 mm.

Habitat: Balzapamba, Prov. of Bolivar, Ecuador.

Cosmosoma biseriatum, sp. nov.

Head and palpi black. Collar black with two metallic blue spots. Thorax black anteriorly, orange posteriorly with a large black subdorsal spot containing some metallic blue scales; the patagiæ orange internally streaked with black; thorax below dark yellow, the legs brown streaked at the base with yellow. Abdomen above orange, the last four segments black; the orange portion with lateral transverse black bands, interrupted dorsally. A lateral row of metallic blue spots on all the segments. Underneath the abdomen is yellow; the last segments black and a black band on basal segment. Wings hyaline with black margins, very wide on the outer margins and at apices. A large black spot at the end of the cell on primaries; a large orange spot at the base of the wings. Underneath the wings at the base are yellow. Expanse, 41 mm.

Habitat: Balzapamba, Prov. of Bolivar, Ecuador.

Cosmosoma bolivari, sp. nov.

Head and palpi black. Collar anteriorly black, posteriorly yellow. Thorax yellow, with subdorsal black spots. Abdomen dorsally brown, the first and sixth seg-

ments yellow, the first having a black subdorsal spot; anal scales yellow. Underneath yellow, the last two segments black. Legs light brown, tarsi yellowish. Wings hyaline; the margins finely black; the apices, inner angle and base of primaries more widely black; costal margin of primaries luteous. Expanse, 23 mm.

Habitat: Balzapamba, Prov. of Bolivar, Ecuador.

Chrostosoma cardinale, sp. nov.

Head and palpi black. Collar, thorax and abdomen red; tibiæ and tarsi brown. Wings hyaline, veins and margins finely black; apices and inner margin of secondaries more heavily black. A red spot at the base of the primaries and some red scales along the inner margin of secondaries. Underneath with the base of the wings red. Expanse, 28 mm.

Habitat: Colombia.

Tsanthrene pentagona, sp. nov.

Body below, legs, head and palpi bright yellow. Collar yellow with a transverse black streak. Thorax black, patagiæ with a central yellow streak. Abdomen above yellow, the last five segments broadly banded with black. Wings hyaline, the veins and fringe reddish brown. Expanse, 24 mm.

Habitat: Peru.

Agunaix lacrumans, sp. nov.

Body black. Primaries smoky black, darkest on the basal half. Secondaries semi-hyaline, black. Expanse, 26 mm.

Habitat: Peru.

The genus *Agunaix* is new and will be described by Sir George Hampson in his work on the Syntomidæ.

Paramya flavia, sp. nov.

Palpi and legs light brown. Body otherwise pale yellow. Wings hyaline, veins and margins finely light brown, the apex and outer margins of primaries, also the inner margin of secondaries more broadly so. Discocellular black. Base of the wings light yellow. Expanse, 23 mm.

Habitat: Castro, Parana.

Phela hæmapera, sp. nov.

Body black; two large crimson spots on collar. Anus crimson. Coxæ and base of abdomen below cream color. Wings hyaline, veins and margins black, most heavily marked at apices and inner angle. A black spot at the end of the cell on primaries. Expanse, 22 mm.

Habitat: Sta. Catherina, Brazil.

Æthria rubipectus, sp. nov.

Palpi black spotted with white. Head black. Thorax black, the collar and patagiæ finely edged with white. Underneath thorax is crimson. Abdomen metallic

blue, the anal hairs very long and black. Wings hyaline, veins and margins finely black; the apex of primaries broadly black. Expanse, 22 mm.

Habitat: San Domingo, W. I.

Napata unifascia, sp. nov.

Palpi and head black speckled with metallic blue. Thorax black mottled with metallic blue. Abdomen above dark metallic blue, below with a white ventral stripe. Legs black streaked with white. Primaries black, the basal half of inner margin metallic blue; a broad median crimson fascia from the subcostal vein and narrowing towards inner angle. Secondaries dark metallic blue with the extreme margin and fringe black. Underneath the same, but on the primaries there is a cluster of metallic blue scales beyond the crimson fascia, and the secondaries have the outer margin and apex more broadly black. Expanse, 27 mm.

Habitat: Chimbo, Ecuador.

Trichodesma obliqua, sp. nov.

Head brown, frons cream color. Thorax and collar brown finely edged with yellowish. Abdomen brown circled with fine yellow lines. Primaries brown; a broad yellow oblique band from the costa, not reaching the inner angle. Secondaries yellow, with the margins broadly black. Underneath the same. Expanse, 30 mm.

Habitat: Rio Janeiro.

SATURNIDÆ.

Automeris naranja, sp. nov.

Primaries olive gray to brown, sometimes shaded with paler in the disk; the antemedial line wavy, indistinct; the postmedial line somewhat curved inwardly from apex, to beyond center of inner margin; this line outwardly dark, inwardly pale. Discal spot large, darker and diffuse, outlined by five black points. Secondaries with the costal and inner margin brownish, with a darker subterminal shade inwardly limited by a black line which also separates it from a deep orange postmedial space which contains the ocellus, the latter being brown with a gray centre and broadly circled with black. Below wings grayish with a dark straight postmedial line and a black discal spot on primaries. Thorax colored like primaries, abdomen blackish above, grayish below. Expanse, ♂, 64 mm.; ♀, 77 mm.

Habitat: Rio Grande do Sul.

Automeris zaruma, sp. nov.

Head and thorax dark velvety brown; abdomen reddish. Primaries yellowish brown, with basal space and postmedial shadings darker, an oblique and irregular bright yellow, antemedial line; the postmedial black, inwardly shaded with yellow, from apex to inner margin at two thirds from base. Secondaries with costal and inner margins reddish; outer margin brownish; a black subterminal band adjoining the larger median space of bright yellow; this yellow space crossed by a black postmedial line; ocellus brown, broadly circled with black and containing a cluster of gray scales crossed by a white line. Underneath the wings are reddish; a large black discal

point with white centre on primaries, a minute white discal point on secondaries. Indistinct dark postmedial lines and subterminal shades. Expanse, ♂, 81 mm.

Habitat: Zaruma, Ecuador.

Automeris castrensis, sp. nov.

Thorax dark brown; abdomen red; anal hairs brownish. Primaries narrow with inner angle rounded, also apex rounded, light brown with an oblique indistinct line from apex to middle of inner margin; this line is inwardly paler, outwardly darker than the ground color; discal spot round small with paler center. Secondaries bright yellow the outer margin narrowly brown, separated from yellow portion by a black line. Ocellus large, black, with grayish centre crossed by a white line. Underneath wings brown with a large round black discal spot on each wing. Expanse, 55 mm.

Habitat: Castro, Parana.

Dirphia muscosa, sp. nov.

Primaries thickly mottled with greenish and black hairy scales; an oblique angular line from the costa at one-third from the base to vein 2, where it is joined by the postmedial line which is crenulate. The lines are black, outwardly shaded with grayish; a dark spot in the cell; in the ♀ the lines do not meet, but extend to the inner margin some distance apart. Secondaries brownish gray in the ♂, fawn color in the ♀, thickly speckled with dark scales, the outer margin and a subterminal line darker in the ♂; in the ♀ only a subterminal line. Thorax same color as primaries; abdomen orange with transverse black bands in the ♂. Expanse, ♂, 80 mm.; ♀, 90 mm.

Habitat: Rio Grande do Sul.

NOCTUIDÆ.

Chorizagrotis sorella, sp. nov.

Body grayish brown, the collar slightly reddish. Primaries brown, faintly tinged with reddish beyond the reniform. Space before the spots dark brown, spots themselves of ground color finely outlined in dark brown; claviform the same; antemedial line geminate, indistinct, forming three curves; postmedial very fine, almost punctiform; subterminal wavy, indistinct with some sagittate spots between veins 3–5. Secondaries semi-hyaline, smoky brown, darkest along the outer margin. Underneath whitish powdered with brown scales; traces of postmedial line and discal spots distinct on secondaries. Expanse, 39 mm.

Habitat: Las Vigas, Cobre de Perote, Mexico.

According to Prof. J. B. Smith this species is allied to *Chorizagrotis soror* Smith.

Peridroma scortea, sp. nov.

Body grayish brown. Primaries light brown; some grayish scales at the base on the inner margin, in the orbicular reniform, along the veins and terminal space. These grayish shades are very indistinct. Antemedial line only visible on costa.

Postmedial fine crenulate. A fine terminal black line, saggitate on veins. Secondaries whitish hyaline, smoky along the outer margin. Expanse, 34 mm.

Habitat: Orizaba, Mexico.

Mamestra gavisa, sp. nov.

Body brown. Primaries dull brown, somewhat shaded with rufous; a black streak at the base; the veins indistinctly grayish; the antemedial pale fawn color finely edged with dark scales; the orbicular and claviform finely outlined with dark scales; the reniform grayish with a distinct white line outwardly, the postmedial fawn color, slightly crenulate and finely edged with dark scales; the terminal space except at apex dark gray with a terminal row of yellowish spots; the fringe mottled gray and fawn color. Secondaries brown, pale at the base. Underneath a postmedial line and discal spot on both wings. Expanse, 32 mm.

Habitat: Las Vigas, Cobre de Perote, Mexico.

Mamestra ciniva, sp. nov.

Head and thorax gray. Abdomen light brown. Primaries silvery gray, thickly speckled with white scales; an interrupted black basal line; the antemedial line black, oblique from the costa to middle of inner margin; the median space a trifle darker; some subterminal black scales; a terminal gray line; fringe white with two gray lines; the orbicular and reniform very indistinct and faintly outlined with black. Secondaries whitish; the veins and outer margin smoky. Expanse, 22 mm.

Habitat: Oaxaca, Mexico.

This species somewhat resembles *M. anguina* Gr., and *M. vecina* Gr., but is much smaller.

Hadena dyschoroides, sp. nov.

Body reddish brown. Primaries light reddish brown, the terminal space except at apex dark brown; the basal line black, geminate, indistinct; the antemedial dark brown, sinuate, a dark median transverse shaded, angled below costa; the postmedial fine wavy, dark brown inwardly shaded with violaceous and outwardly followed by two rows of dark points; the dark terminal space preceded by a wavy violaceous line, a bright yellow spot in the reniform. Secondaries brown, the fringe reddish. Underneath grayish brown; a dark postmedial spot on costa of primaries. Secondaries with a discal spot and postmedial line. Expanse, 21 mm.

Habitat: Orizaba, Mexico.

Hadena orizabena, sp. nov.

Head and thorax violaceous brown; abdomen light brown. Primaries violaceous brown; the central portion of median space darker; some dark scales at the base; the antemedial line paler, irregularly oblique from costa to a paler space on the middle of inner margin; the postmedial similar, slightly sinuate to middle of inner margin also, but not quite touching the antemedial line; orbicular very indistinct, reniform with a large white spot; a subterminal row of white points inwardly preceded by sagittate dark violaceous shadings. Some minute reddish brown spots on costa and

extreme outer margin; fringe dark violaceous brown. Secondaries light brown. Underneath light brown with a postmedial line and discal spot on secondaries. Expanse, 25 mm.

Habitat: Orizaba, Mexico.

Hadena zuelana, sp. nov.

Palpi, head and collar pale fawn in color. Thorax brown. Abdomen gray; dorsal tufts reddish brown. Primaries with the basal half brown, the outer half gray, the basal half sometimes mottled with paler shades; the antemedial and medial lines fine, geminate, very indistinct; the postmedial line fine, dark, very wavy and twice sinuate beyond the cell; the apex darker, with a lunate subapical line outwardly shaded with white; some dark subterminal shadings at the inner angle; the spots indistinct and faintly outlined. Secondaries with the basal half white, the outer half black. Expanse, 34 mm.

Habitat: Aroa, Venezuela.

Out of eight specimens I have of this species no two are absolutely alike and the variation is greater than the description implies.

Eurois bertha, sp. nov.

Head and thorax mottled brown and white. Abdomen light brown. Primaries brown. A pink spot at the base; the basal line white, inwardly shaded with dark brown; the antemedial and postmedial lines fine white, the basal and postmedial spaces slightly speckled with white. On median space the median and submedian veins pink; the spots circled with white; the orbicular dark brown, the reniform in the shape of 8, pink and brown; a dark brown space between the spots and a dark brown spot beyond the reniform. The terminal space mottled with light brown, some subterminal black streaks; a terminal dark line interrupted on the veins. Fringe mottled with gray. Secondaries brown, fringe partly white. Expanse, 30 mm.

Habitat: Castro, Parana.

Eurois orbiculata, sp. nov.

Palpi yellow, laterally brown. Head yellow. Collar and throat mottled yellow and gray. Primaries mottled white and olivaceous brown; the basal line dark olive, the antemedial white, interrupted, and outwardly bordered with a black line; a dark olive space in the cell between the spots. The orbicular small, white; the reniform large, mottled gray and white; the postmedial dark, fine, crenulate, angled beyond the cell, inwardly shaded with white; a subterminal wavy greenish white shade; a terminal black line inwardly shaded with white and interrupted in the veins. Fringe olivaceous with pale streaks opposite the veins. Secondaries light brown. Underneath primaries brownish. Secondaries gray with discal spot, postmedial and subterminal shading. Expanse, 34 mm.

Habitat: Castro, Parana.

Platysenta obscura, sp. nov.

Head, collar and thorax black. Abdomen brown. Primaries black, brown along the inner margin, in the cell and towards apex. A velvety black streak at base

below median vein, some indistinct subterminal brown streaks between the veins. Orbicular brown, outlined in velvety black. Reniform, small, round whitish circled with black and crossed with two black lines; a terminal black line, fringe mottled brown and gray. Secondaries white, the veins black on the outer margin. Expanse, 33 mm.

Habitat: Orizaba, Mexico; Sao Paulo, S. E. Brazil.

Stibadium corazona, sp. nov.

Body gray. Primaries apparently gray, the ground color being olive brown, very thickly irrorated with whitish scales. The antemedial line fine, pale, nearly straight; the postmedial pale, angled beyond the cell and then straight to inner margin, above which it is inwardly shaded with olivaceous; a pale subterminal shade straight from apex to angle of postmedial, then wavy to inner angle. Secondaries grayish brown, with an indistinct subterminal pale line. Expanse, 35 mm.

Habitat: Orizaba, Guadalajara, Mexico.

Stibadium jalada, sp. nov.

Head and thorax rufous. Abdomen brown. Primaries olivaceous brown, thickly speckled with lilacine scales, the outer margin paler; the lines fine olive brown, devoid of lilacine scales; the antemedial angular, the postmedial forming a large curve beyond the cell; the medial line geminate, indistinct. Secondaries grayish brown, with a fine postmedial line. Expanse, 33 mm.

Habitat: Guadalajara, Mexico.

Plagiomimicus musculus, sp. nov.

Head and thorax light gray, abdomen light brown. Primaries mouse gray; an indistinct antemedial whitish line angled at the cell; a broad white band indistinctly divided by a grayish line from the costal margin close to the apex to just beyond the middle of inner margin. Secondaries grayish white. Primaries below grayish. Secondaries below white, speckled with gray on the costal margin. Expanse, 24 mm.

Habitat: Oaxaca, Mexico.

Grotella dulcita, sp. nov.

Body and primaries bright silky yellow. Secondaries dark gray, the fringe yellow. Underneath primaries dark gray with the costal margin and fringe yellow. Secondaries below light gray. Expanse, 23 mm.

Habitat: Guadalajara, Mexico.

Eustrotia malonia, sp. nov.

Palpi black. Head and collar white. Thorax and abdomen brownish yellow speckled with white. Wings pale creamy brown. Primaries with a black spot at the base of the costa; an antemedial white wavy band, spotted with yellow, and starting from a conspicuous black spot on the costa; the postmedial line fine, white, shaded with brown and also starting from a black costal spot, then curved beyond the cell, and wavy to the inner margin; a heavy white subterminal shade; an interrupted terminal black line; fringe grayish brown, spotted with white. Secondaries pale

brown, shaded with white at the base and along the inner margin; a terminal dark line; fringe mottled brown and white. Expanse, 22 mm.

Habitat: Sao Paulo, S. E. Brazil.

GEOMETRIDÆ.

Pityeja picta, sp. nov.

Head and thorax cream color, the latter speckled with reddish brown; abdomen cream color. Primaries with the base cream color defined by a reddish oblique line; the antemedial line very oblique to the centre of the inner margin, reddish brown; the space before it light brown mottled towards the base with white; the postmedial line nearly straight from costa to vein 4, and then forming an inward curve to near the inner angle; the median space white crossed by reddish brown veins and some transverse striæ especially in the cell; beyond the postmedial line the wing is dark gray shading to reddish brown on the outer margin, mottled with darker striæ; near the apex some reddish spots. In the ♀ the dark basal and postmedial spaces are thickly spotted with white. Secondaries white, the inner and outer margins, especially about the anal angles, light reddish brown with some grayish striæ. A terminal blackish line, and a black spot on the prolongation between veins 3 and 4. Expanse, 29 mm.

Habitat: Jalapa, Mexico.

Ophthalmophora fasciata, sp. nov.

Body brown. Primaries dark brown, crossed by a broad median yellow band, very wide on the costal margin, narrowing at the median vein and then widening slightly to the inner margin; some yellow spots on the extreme margin and fringe yellow, except from veins 2–4, where it is brown. Underneath the same but no spots on the margin except at anal angle. Secondaries above dark brown; the apex, outer margin and fringe yellow; a subterminal silvery line and four postmedial ocelli black, circled with yellow and containing some silvery scales. Underneath the same but without the ocelli or silvery line. Expanse, 23 mm.

Habitat: Castro, Parana.

This species is closely allied to *O. asopis* Druce.

Aplogompha chotaria, sp. nov.

Body yellow; two longitudinal brown streaks on thorax. Abdomen with brown spots and transverse lines. Primaries yellow with transverse rows of small quadrate brownish spots; basal, subbasal, antemedial and medial complete; the postmedial and subterminal rows coalescing between veins 4, 5 and 6, and represented by a single spot on the inner margin; a terminal row of smaller spots. The spots along the costa, the terminal and some of the subterminal spots shaded with metallic scales. Secondaries yellow with similar rows of spots, the terminal and subterminal rows also shaded with metallic scales. Expanse, 16 mm.

Habitat: Jalapa, Mexico; Aroa, Venezuela.

Bapta ruptilinea, sp. nov.

Primaries silky white, thickly irrorated with creamy scales and sparsely speckled with dark brown. An indistinct antemedial shade not reaching the costa; the post-

medial shade broad, interrupted between the veins giving it a denticulate appearance; a terminal row of black poin's. A black point in the cell. Secondaries similar but with only the postmedial shade, which does not reach the costal margin and is most distinct on the inner margin. Expanse, 26 mm.

Habitat: Castro, Parana.

Allied to *B. hebetior* Warr, from the same locality.

Lozogramma (?) setaria, sp. nov.

Wings pale silky grayish brown. An almost imperceptible wavy brown antemedial line; a minute discal point; a postmedial straight brown line edged on either side with dark brown. Secondaries with a trace of a postmedial line on the inner margin. Expanse, 23 mm.

Habitat: Castro, Parana.

Semiothisa oaxacana, sp. nov.

Wings entire, very pale reddish brown, darker beyond the postmedial line, thinly speckled with dark brown scales; the veins and a postmedial line buff, the latter straight on the primaries, slightly wavy on the secondaries; traces of a fine medial line on the primaries. A minute black spot in the cells, terminal black points between the veins, underneath the same. Expanse, 26 mm.

Habitat: Oaxaca, Mexico.

Microgonia gilva, sp. nov.

Pale yellow, tinged with green, the basal and medial space on primaries somewhat grayish, iridescent. An irregular antemedial black line edged with whitish scales; a minute black discal point; the outer line fine, black, outwardly bordered with white, angled near apex and then slightly wavy to middle of inner margin; this line is continued on secondaries where it is still more wavy; the outer margin with lilacine striæ and three subterminal cuneiform marks; a wavy lilacine subterminal shade on secondaries. Underneath primaries bright yellow, except inner margin which with secondaries is grayish; the outer line brownish, broadly shaded outwardly with white on the primaries; on the secondaries it is perpendicular from costal margin to below cell where it forms a large curve to centre of inner margin. Expanse, 56 mm.

Habitat: Castro, Parana.

Allied to *M. mexicata* Gn., but readily distinguished by color, wavy line on secondaries and absence of glaucous spot on inner margin of primaries.

Microgonia fulcata, sp. nov.

♂ olive green, ♀ dark brown. Primaries very acute as in *platypterata* Gn.; a fine basal line; an antemedial line oblique from costa to median vein, then slightly wavy, perpendicular to inner margin; a minute discal point followed by an oblique dark shade from costa; outer line curved from costa to nearly outer margin, then angled and inwardly oblique to inner margin at two-thirds from base; this line is heavily marked and dark brown followed by a narrow pale shade and is continued on the secondaries to middle of inner margin; there is also an angular subterminal shade

on secondaries. Underneath the wings are grayish in the ♂ with brownish mottlings; the outer margin on primaries and apex being dark brown. In the ♀ underneath wings are dark brown suffused with lilacine; the primaries with a white mark before the apex, and some postmedial white spots on secondaries. Expanse, ♂, 57 mm.; ♀, 67 mm.

Habitat: Castro, Parana.

This species is very distinct.

Azelina castraria, sp. nov.

Antennæ simple. Wings hardly dentate. Body and primaries dark greenish gray shaded with buff in the cell. The inner line wavy, oblique from the costa at a third from the base to the inner margin beyond the middle and nearly contiguous to the outer line which is nearly straight and runs parallel with the outer margin. Both lines finely velvety brown, shaded with olive green which nearly fills the base of the V formed by the two lines. A minute black discal point. The outer line is outwardly shaded with lilacine, then with a dark greenish shade and finally with pale buff. All these colors running into each other. Secondaries buff, speckled with dull greenish gray. The inner margin and anal angle reddish brown. A submarginal dark shade, divided by a faint buff line. Underneath grayish, the costal half of each wing reddish brown, mottled with gray. An indistinct white outer line and a black discal spot on the secondaries. Expanse, 33 mm.

Habitat: Castro, Parana.

Nearest *Azelina scitaria* Obt.

Subfamily ASCOTINÆ.

Psilopora thesea, sp. nov.

Wings gray, thinly speckled with dark brown, the lines dark brown: the antemedial fine, perpendicular to subcostal, then a curve to near submedian and then inwardly oblique to inner margin. A dark discal point; beyond this a curved median line and a wavy punctiform postmedial line; the space between these two lines filled in with dark brown from inner margin to vein 4; a fine reddish shade beyond postmedial and a darker subterminal grayish line; a terminal row of black points. Secondaries with a broad dark median fascia from inner margin, slightly bifurcating at cell and not reaching costal margin; a postmedial punctiform line, followed by two fine reddish shades; the margin darker gray. Expanse, 26 mm.

Habitat: Castro, Parana.

Physocleora tascaria, sp. nov.

Wings white, finely powdered with light brown, lines fine, indistinct and interrupted, marked by larger spots on the costa; the postmedial punctiform, the largest spot being between veins 3 and 4 and is followed by a bright yellow spot, a terminal row of dark points. Secondaries with the lines more distinct, the basal fine, wavy; the median distinct, just beyond the cell spot, and geminate; a postmedial and subterminal grayish shade; terminal spots between the veins. Underneath primaries

dark gray, secondaries sordid white, discal spots and terminal wavy dark line. Expanse, 21 mm.

Habitat: Castro, Parana.

Physocleora obscura, sp. nov.

Wings gray in the ♂, light brown in the ♀; the basal space and costa grayish, the former limited by a dark line, nearly straight. A perpendicular fine median line; the postmedial wavy, geminate, the space within filled in with reddish brown; the margin mottled brown and gray with an irregular angular white subterminal line, enclosing some cuneiform black marks. Secondaries heavily powdered with gray; the antemedial line heavy, dark gray, the postmedial fine, indistinct, followed by reddish brown shadings. A terminal dark line on both wings, thickened between the veins. Underneath gray, primaries with a basal, median, postmedial and subterminal dark lines, the latter outwardly shaded with white. Secondaries with a broad antemedial band and a fine postmedial line. Expanse, ♀, 21 mm.

Habitat: Castro, Parana.

Physocleora punctilla, sp. nov.

Wings white with a few black speckles; lines black; the antemedial forming a large curve, the space within being shaded with light brown; a black median spot on costa and a small discal spot below it; the postmedial line fine wavy, followed by a distinct reddish brown shade; the marginal space heavily shaded with dark gray, divided by a subterminal white angular line; a terminal row of black points. Secondaries the same, but with the discal spot larger and more distinct. Underneath gray, the margins broadly darker. A postmedial punctiform line and discal spots. Expanse, 15 mm.

Habitat: Castro, Parana.

Stenalcidia nortonia, sp. nov.

Pale gray, speckled with brown scales. A fine antemedial line, punctiform on subcostal and median veins; an oblique median yellowish line not extending above cell; a postmedial punctiform line nearly straight from near apex to middle of inner margin, followed by a broad smoky shade; margin darker with a terminal row of dark points. Secondaries with a broad antemedial dark band; the postmedial line fine, followed by two reddish gray lines; a terminal row of black points. Underneath darker gray; on the primaries a straight postmedial line, and on the secondaries an antemedial band and postmedial line; the lines somewhat punctiform. Expanse, 26 mm.

Habitat: Castro, Parana.

Described from a well-marked ♂. The secondaries are slightly excavated below apex with a slight tooth at vein 4 and then the margin is straight to anal angle.

Stenalcidia cindica, sp. nov.

Wings whitish thinly powdered with gray; lines dark brown; the antemedial slightly curved and inwardly oblique to inner margin, marked by a large dark spot on costa, a smaller one on median vein and inner margin, preceded by an oblique

light reddish brown shade; the median line less distinct, wavy, and slightly curved, marked by a dark spot on costa; the discal point forms part of the line; the postmedial line thickened in places, slightly curved to below vein 2 where it touches the median line and then perpendicular to inner margin; this line is followed by a light reddish brown shade; a subterminal lunular white line heavily shaded with dark gray on either side, especially between veins 4 and 6; beyond this the veins are shaded with light reddish brown; a terminal row of black triangular spots between the veins; fringe pale, spotted with gray. Secondaries with an antemedial line straight; discal spot distinct; postmedial finely acute, followed by a broad reddish brown shade; subterminal line dark gray, angular; beyond this a row of triangular grayish spots filled in with reddish brown; a terminal black line, thickened between the veins. Underneath sordid white with antemedial and postmedial punctiform lines, the fringe also distinctly spotted. Expanse, 28 mm.

Habitat: Castro, Parana.

The female is larger, more thickly irrorated with gray, and the lines very fine and punctiform.

Tephrina submarcata sp. nov.

Wings above sordid white, irrorated with brown scales; the lines hardly perceptible, but strongly marked by four brown blotches on costa of primaries; a brown discal spot; fringe brown, at inner angle buff; a terminal row of dark spots between the veins Secondaries more heavily irrorated with brown along the outer margin; a faint postmedial line and subterminal shade; an interrupted terminal brown line; fringe buff. Underneath yellowish with strong brown mottling and striæ. The postmedial line straight and broad on primaries, punctiform on secondaries. Expanse, 26 mm.

Habitat: Guadalajara, Mexico.

Tephrina griseata, sp. nov.

Body and wings dull gray; fine antemedial, medial and postmedial lines, the latter closely followed by a dark subterminal shade not extending above vein 6; the lines marked by a dark spot on costa. The extreme costa mottled with buff. A small discal spot with pale centre. Fringe buff interrupted by darker scales. Secondaries with antemedial, postmedial and subterminal lines very indistinct. Underneath pale gray thickly clouded with darker gray. Expanse, 25 mm.

Habitat: Jalapa and Oaxaca, Mexico.

Tephrina guadarana, sp. nov.

Wings dove color, the veins yellowish; costa yellowish with some black striæ; a curved antemedial yellowish line, inwardly shaded with black; a straight postmedial yellowish line, outwardly shaded with black, at four fifths and parallel to the outer margin. Secondaries with a straight postmedial yellowish line not reaching the costal margin. A blackish discal spot in cells of both wings. Underneath buff, powdered with gray. Expanse, 31 mm.

Habitat: Oaxaca and Guadalajara, Mexico.

This species comes nearest to *T. irrorata* Pack.

DESCRIPTION OF LARVÆ OF HEMILEUCIDS FROM THE ARGENTINE REPUBLIC.

By HARRISON G. DYER.

Hyperchiria coresus *Boisduval.*

Larva shaped as *H. io*, large, cylindrical, with prominent head. The body bears bunches of long stinging spines as in *H. io*, three rows on joints 2 to 13 on each side, a single dorsal one instead of the first row on joints 12 and 13, anal plate bare; a fourth row on joints 2 to 6. 11 and 13. The shaft of the tuft of rows 1 and 2 is very long (10 mm.) except the mid-dorsal of joint 13, which is rudimentary; row 3 is small, especially on the abdomen, not over 2 mm. in length and row 4 is still smaller. A few fine secondary hairs, short and pale Color green, a narrow, broken black, substigmatal line on joints 5 to 13, edged below by a white band; a black patch, dotted with white on the anterior side of the segment subventrally on joints 6 to 12; anal plate blackish, pale dotted. An eversible gland behind the spiracle on joints 5 and 11. Width of head, 6 mm.; length of larva, 80 to 100 mm.

Hyperchiria viridescens *Walker.*

Three rows of tufts of spines on joints 2 to 13, single dorsal on 12 and 13; a fourth row on joints 2 to 6, 11 to 13. Spine shafts short, subequal, the spines coarse, the upper row bearing piercing caps, the two lower rows setæ only. Rather numerous, pale, secondary hairs most abundant and longest on the feet. Color black, the head, leg plates and anal plate shining, the body sooty. Spines pale yellowish, contrasting. Width of head, 6 mm. The eversible stigmatal glands cannot be made out in the specimens. This differs unexpectedly from the other species in the presence of a fourth spine tuft on join 12 (tubercle vii not aborted).

Eudyaria venata *Butler.*

Head large, smooth, not bilobed, rounded. shining brown, the mouth and a spot covering the ocelli black; width, 7.5 mm. Body with tufts of stinging spines arranged exactly as in *H. viridescens* described above, the fourth row present on joint 12. Body black, the feet and anal plate shining; the segmental incisures from joints 3 to 12 are occupied dorsally as far as the third spine tuft by broad reddish brown, transverse bands, contrasting with the body. Spines ocherous brown like the head. A few blackish, rather stiff, secondary hairs.

Hylesia nigricans *Berg.*

Head rounded, smooth, shining black, curiously marked with white streaks; a line on the vertex in the median suture, an inverted V mark over the clypeus, a dash above each eye, joined by a spur above to a quadrate patch on the posterior side of the head; width, 3.5 mm. Body with rows of spine tufts as in *H. viridescens*, the fourth row present on joint 12; row 1 on joints 5 to 12 is somewhat shorter than rows 2 and 3 but not so markedly as in *Hemileuca* and *Pseudohazis*, from which this larva also differs in the presence of the fourth spine on joint 12. Rather numerous, pale, secondary hairs are present. Body black, a broad white stigmatal band, white dots at the bases of the secondary hairs and pale streaks in the segmentary incisures. Spine shafts brown-black, the spines brownish.

I am indebted to Mr. G. Ruscheweyh for sending me these larvæ.

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THE LIFE HISTORIES OF THE NEW YORK SLUG-CATERPILLARS.—XVI, WITH CERTAIN ADDITIONS AND CORRECTIONS.

PLATE VIII.

By HARRISON G. DYAR, A.M., PH.D.

Tortricidia testacea *Packard.*

1864—	*Tortricidia testacea*	PACKARD, Proc. Ent. Soc. Phil. III, 337.
1882—	" "	GROTE, Check List, Bombyces, no. 195.
1891—	" "	SMITH, List. Lep. no. 1211.
1892—	" "	KIRBY, Cat. Lep. Het. I, 551.
1894—	" "	NEUMOEGEN & DYAR, JOURN. N. Y. ENT. SOC. II,

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space moderately broad, narrowing only a little toward the extremities, arched; lateral space broad, oblique, concave; subventral space small, retracted. Ridges slightly prominent, never tubercular, furnished with single or furcate swollen-tipped setæ in stage I, afterward with rudimentary setæ which nearly disappear at maturity. Outline from dorsal aspect elliptical, notched at the anterior part of joint 13 to form a short quadrate tail. Skin covered with close, appressed, rather large, clear granules, which appear immediately after first molt, a little papillose on the margins, becoming smoother and increasing in number at subsequent molts. Depressed spaces large, well developed, deep, with sharp sides, the bottom flat and finely granulated. The spaces (1) to (8) are present, dividing the surface into a series of raised latticed ridges.

The larva is throughout very smooth. The coloration is green with a large red mark appearing in the middle of the back, finally reaching head and tail and the middle of the sides.

This species is more generalized than its ally, *T. pallida*. It is the stem form, from which *pallida* is just beginning to diverge. It is the more northern form of the two and in this again shows its ancestral condition, since, belonging to the Palæarctic Eucleids, it is less distantly removed from the ancient habitat of the group.

AFFINITIES, HABITS, ETC.

This larva is closely allied to *T. pallida*. It has all the same structure and coloration, differing only in certain details which might be considered to be of but varietal rank, except that they prove to be constant. The certain differentiation of these larvæ is difficult except when the whole life history is seen, and then a number of differences appear. The real difference between the species is found in the date of occurrence. The moths of *testacea* emerge unusually early, nearly a month before the allied species. My dates are June 10th to 14th for moths bred at Long Island. Professor G. H. Hudson finds June 9th to 22d for all the moths he has taken at light at Plattsburgh during a series of years. Consequently, full grown larvæ are found early, often during July at the time when *T. pallida* is hatching. This is not a case of two differently colored broods, as I thought at one time. Both species are strictly single brooded, like all the other northern Eucleids. The power of early emergence gives *T. testacea* a northern range, since it pupates in time to avoid early frosts. In the Adirondacks it was the only Eucleid met with.

The larva is a rather low feeder, occurring in the same situations as its ally, *T. pallida*. The habits are the same. There are seven larval stages, occasionally six by the omission of stage II and still more rarely eight by the interpolation of an extra stage before the last, as Mr. L. H. Joutel tells me happened to a larva that I sent him to breed.

CRITICISM OF PREVIOUS DESCRIPTIONS.

I have no references to this larva as such. Probably the descriptions referred to *T. pallida* cover *testacea* in part, but I find it difficult to sort them out without dates of occurrence. The diagnosis given by Miss Morton and myself (JOURNAL N. Y. ENT. SOC., III, 146) of (?) *T. testacea* refers more probably to *Kronæa minuta* Reakirt. Miss Morton thought she had bred the larva, getting an imago *testacea*, but there must have been some error. I followed her opinion at the time of writing the synopsis as I had not then bred *testacea* myself. A corrected table will be given at the end of these articles. My account of *T. pal-*

lida (JOURNAL N. Y. ENT. SOC., IV, 167–172) contains many sentences referring to *T. testacea.* Having wrongly identified the larva of *testacea* and being under a misapprehension as to the close relation of several of our smooth red-spotted Eucleids and further desirous of including all the varieties of *pallida* while I was writing about it, I went too far and included portions taken from larvæ of other species. The account, therefore, is based on *Tortricidia pallida*, *T. testacea* and *T. (Heterogenea*) flexuosa*, confused together. It is fully corrected herewith, with illustrations of both species.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg. Elliptical, flat, whitish translucent on white leaves, shining; reticulations faint, narrowly linear, elongate. Size 1.0 × .6 mm. Laid singly on the under side of the leaf.

Stage I. (Plate VIII, fig. 1). Elliptical, rather elongate, dorsal and lateral spaces rather broad. Setæ as in *T. pallida*, the Y-shaped ones large, strongly alternating, those on joints 5, 7, 9 and 11 leaving out. Color translucent whitish with a slight green tint. Skin smooth. Length .7–1.1 mm. The larva feeds during this stage.

Stage II. Distinct short black setæ, two on subdorsal ridge, one on lateral ridge on the abdominal segments. Subdorsal ridge rather square, dorsum flat, rounded; tail quadrate; sides concave. Lateral ridge moderate, subventral space small, retracted. Depressed spaces all present as in the mature larva, deep, sharp, the latticed ridges composed of one row of large clear granules, becoming subpapillose on the lateral ridge. Color pale greenish without marks. Length, 1.1–1.7 mm., or reaching 2.2 mm. in six-stage larvæ.

Stage III. Elliptical, tail rounded quadrate; all pale green. Skin structures the same as before; setæ quite distinct. Length, 1.6–2.2 mm. Six-stage larvæ, which have omitted stage II, have the size and coloration of the next stage.

Stage IV. (Plate VIII, figs. 2, 3). Elliptical, both ends rounded, the anterior more obtusely; dorsum arched. Ridges low, the subdorsal shorter than the lateral. Body smooth, setæ nearly obsolete. Skin coarsely clear-granular except in the large depressed spaces which are finely granular and on the lateral ridge where the granules become subpapillose. Color light yellowish green; during the stage the subdorsal

* I find that none of the American species belong to *Heterogenea* Knoch except *shurtleffi* Pack. which is distinct from *cæsonia* Grt. A generic revision will follow.

ridge becomes pale, a large rounded quadrate reddish spot appears dorsally, covering joints 7 to 9 and reaches the subdorsal ridge; as the stage advances this becomes better defined, regularly elliptical, covering joints 6 to 10 and reaching nearly half way down the lateral space. It is bordered with yellow, this color extending also backward and forward for some distance along the subdorsal ridge (Plate VIII, fig. 3). Length, 2.2 to 3.3 mm.

Stage V. (Plate VIII, fig. 4). Shape as before. Skin surface the same, but the granules on the latticed ridges are more numerous. Setæ obsolete, scarcely discernible except at the ends of the body. Color green, dorsal patch elliptical, but now a little angled at the sides, a slight point projected to the depressed space (4) of joints 6–7 and 9–10 and a more decided one reaching below the space (4) on joint 8. The patch is rounded before and behind and contains a varying paler central space, which may be so large as to reduce the patch to a red line but is usually small and quadrate. Yellow border distinct, reaching as a subdorsal line nearly to head and tail. Depressed spaces greenish. Length, 3.5 to 4.7 mm.

Stage VI (Plate VIII, fig. 5). Structure as in the mature larva and as before. Color green, the depressed spaces concolorous. A large red patch of varying shade covers the center of the back, more rounded out and larger than before and enclosing six of depressed spaces (1). Its outline is elliptical, a little irregular or notched on the sides, the furthest lateral extension being on joint 8 where it reaches depressed space (5). The patch does not reach either extremity, though a small detached red spot may occur on joint 3. There is a more or less distinct central, square, pale blotch on joints 7, 8, sometimes large as before. A single example found on hickory had the patch blackish chocolate, narrowly bordered with red and yellow. Length, 4.7 to 6.7 mm.

Stage VII.—(JOURN. N. Y. ENT. SOC., IV, pl. VI, figs. 5, 6, 7) shape as described. Depressed spaces as in *T. pallida* (l. c. pl. VI, f. 8). Latticed ridges coarsely clear granular, the depressed spaces finely granular. Color green, depressed spaces pale with dark centers. Dorsal mark reaching the extremities and lateral margins in the form of a cross with four projections from the center which touch the depressed spaces (4) of joints 6–7 and 9–10 (l. c. pl. VI, f. 6), or filled out to a larger diamond-shaped mark, produced narrowly forward to joint 3 (l. c. pl. VI, f. 7). It has a pale salmon-colored center, often square and covering only one depressed space (joints 7–8) or rarely larger, occasionally wanting. The patch is bordered with crimson and yellow

and is usually darker around the edge and on the latticed ridges. The exact shape is variable, but the points mentioned form its boundaries between which the outline may be contracted or expanded. Length, 6.7 to 9.5 mm.

Cocoon with the characters of the group.

Food-plants: Oak, wild cherry, birch, hickory, chestnut, witch-hazel and sour gum have been observed.

ADDITIONS AND CORRECTIONS.

As it was necessary to make the corrections to the account of *T. pallida* with this plate, I have included all additions and corrections that have occurred to me to date, to all the articles that I have published on Eucleid larvæ in this JOURNAL. Corrections to the introductory article will be deferred to the concluding remarks.

Apoda y-inversa *Packard.*

This JOURNAL, III, p. 151. Omit the reference to the larva. *A. y-inversa* larva was undescribed previous to our article.

This JOURNAL, III, p. 152, lines 8, 9. Omit the words "in which the larva does not feed." P. 154, *Stage I.*—Add "The larvæ feed in this stage. Length, .9 to 1.5 mm. Subdorsal setæ of joints 5, 7, 9 and 11 lean outward, lateral of joint 5 leans upward."

This JOURNAL, III, Plate VI, Fig. 1. The alternation of the setæ is wrongly represented.

Sibine stimulea *Clemens.*

Comparison may be made with the allied South American species referred to by me (Can. Ent., XXIX, 77).

Tortricidia pallida *Herrich-Schäffer.*

This JOURNAL, IV, 167, et seq. *Special structural characters,* line 5 of paragraph, omit the words "smooth or;" p. 168 line 10 for "setæ practically" read "tubercles."

Affinities, Habits, etc. Read as follows: This larva is typical of the red-marked smooth Eucleids, a subdivision of the Palæarctic group. It is most nearly allied to *T. testacea,* less closely to *H. flexuosa.* It represents a more primitive state than *Apoda* in that setæ i*a* and i*b* on joint 4 and i and ii on joints 5 to 12 are partly united into a furcate or Y-shaped spine, both limbs of equal length, whereas in *Apoda* one limb has been reduced to a slight prominence.

The moths emerge rather late in the season. Professor G. H. Hudson has taken them at light between June 26th and July 29th at Plattsburgh during several years. My own dates for bred moths are July 8th to 19th.

Full grown larvæ are not found till September. In Long Island, eggs and young larvæ were found on the trees at the time the larvæ of *T. testacea* were maturing.

This larva is a little more specialized than *T. testacea*, in that the dorsal patch becomes earlier defined and grows larger while the granules are a little more papillose. The two larvæ, however, are not distinguishable in any strong character.

The larva is rather a low feeder, occurring on higher bushes and the lower branches of trees, along the edges of woods, etc., not as a rule in very shaded locations. Rarely more than one larva is found on the same plant. They are well scattered, not affecting any particular tree and occurring almost everywhere, not abundant locally and elsewhere rare as *H. flexuosa* is. The larva remains on the back of the leaf where its shape and color are adapted to its concealment.

Criticism of Previous Descriptions. The "*T. testacea*" that Dr. Packard described from a larva I sent him, may be correctly named. The date of occurrence would decide.

Description of the Several Stages in Detail. Stage I.—Add: Setæ large, strongly alternating, those on joints 5, 7, 9 and 11 leaning outward.

Stage II.—Read: Elliptical, narrowed behind, tail quadrate. Subdorsal ridge rather square, dorsum flat, rounded; sides concave. Lateral ridge moderate; subventral space small, retracted. Setæ short, distinct, pointed, black, two on subdorsal ridge, one on lateral ridge on abdomen. Depressed spaces large, sharply edged, deep, as in the mature larva. Latticed ridges apparently one granule wide, but not smooth and clear, being all finely papillose, especially on the lateral ridge, though also showing on the subdorsal ridge, feathery and frosted. Color frosted whitish, no marks. Length, 1 to 1.6 mm.

Stage III.—Read: Elliptical, tail rounded quadrate, structure as before. Setæ still distinct, short, black. Skin neatly granular as in *T. testacea*, papillose only around the margin. Colorless, greenish, a faint red shade centrally on the subdorsal ridges. Later this develops into a large red patch, becoming rounded, the depressed spaces covered by it pale. Length, 1.6 to 2.5 mm.

Stage IV.—(Plate VIII, fig. 8). Elliptical, both ends rounded, the

anterior more obtusely; dorsum arched, the highest point a little before the middle; tail quadrate. Ridges low, not prominent, the subventral shorter than the lateral. Body smooth, setæ still visible. Depressed spaces large, the latticed ridges beginning to be more than one granule wide, those of the subventral ridge subpapillose or slightly cleft. Color whitish, green only in front; dorsal red patch large, covering joints 6 to 10, pentagonal, truncate before, widest at joint 8 where it reaches the lower border of the depressed space (4), tapering behind nearly to a point; a central pale patch and distinct yellow border, produced as a subdorsal line behind, but not in front. Length, 2.6 to 3.7 mm.

Stage V.—(Plate VIII, fig. 9). Page 170, lines 31, 32, 39, 40 and page 171 lines 1 and 2, omit all reference to the coloration and read: green in front, the dorsal patch larger than before, more distinctly angled and pointed in front; it covers six depressed spaces and reaches on the sides to depressed space (5). There may be a small red patch on joint 3.

Stage VI.—(Plate VIII, fig. 10). Page 171, lines 8 to 13, omit all referring to the coloration and read: A large dorsal purplish red patch almost exactly as in the mature larva, but not reaching either extremity. Line 7 for "may have" read "has."

Stage VIII.—(Plate VIII, fig. 11). Page 171, lines 27 and 28, omit the words "from narrow to broad and." Omit also the references to the plate and the foot-note at bottom of page. Lines 36 and 37, omit "thus forming a large blurred red cross." There is no particular resemblance to a cross in *T. pallida.*

This JOURNAL, IV, pl. VI, figs. 5, 6 and 7 represent *T. testacea* not *T. pallida.* Compare the accompanying plate (Plate VIII, figs 8, 10 and 11) for the correct representation of *T. pallida.* Figs. 3 and 4 represent *H. flexuosa* not *T. pallida.*

Phobetron pithecium *Abbot & Smith.*

This JOURNAL, IV, 178. Add as reference to the larva, 1869—Melsheimer, Harris' Ent. Corresp., p. 112 (as *Oiketicus*).

Sisyrosea textula *Herrich-Schäffer.*

This JOURNAL, IV, 187. Add the following description of the freshly laid egg: Large, colorless, a little milky whitish, shining; 1.8 × 41. mm. and almost without thickness (about .1 mm.); reticulations distinct, raised, whiter than the egg. Hatches in not less than ten days.

Stage I.—Mr. Joutel has seen this stage with the subdorsal horns of joints 6 to 12 degenerate, the rest normal. The degenerate horns had

three large, and a group of smaller setæ on joints 6 and 12, three large and other very rudimentary ones on joints 5 to 11. This is a most interesting variation as foreshadowing the condition of the more specialized species where but three setæ remain.

EXPLANATION OF PLATE VIII.

Tortricidia testacea.

Fig. 1. Larva, stage I, dorsal view, enlarged.
" 2. Larva, stage IV, dorsal view, early in the stage.
" 3. The same, later in the stage.
" 4. Larva end of stage V.
" 5. Larva end of stage VI.
" 6. *T. testacea*, imago.

Tortricidia pallida.

Fig. 7. Side view of mature larva.
" 8. Larva end of stage IV (compare fig. 2).
" 9. Larva end of stage V (compare fig. 4).
" 10. Larva end of stage VI (compare fig. 5).
" 11. Larva stage VII (compare this JOURNAL, IV, pl. VI, figs. 6 and 7).

LIFE-HISTORY OF CALYBIA SLOSSONIÆ.

BY HARRISON G. DYAR.

I am able to present descriptions of the remaining stages of this larva which, with those previously given by me, will complete the life-history. The previous article may be amended as follows:

This JOURNAL, V, p. 123, line 1, read . . appendages of nearly equal length at maturity, the anterior ones a little shorter, but in stages II and III of unequal length as in *Phobetron*. Page 124, line 1 for "except that this character may not be primary," read: except that this character is a secondary adaptation.

Add: I have recently received a specimen of this species from Mr. Graef labeled "Texas."

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Add: duration of this stage six days; 15 days in a cold room in New York.

Stage I.—Add: the dorsal and subdorsal brown lines are broken, existing as dashes on the weak segments 4–5, 7, 9 and 11; a slender brown marking between the horns of 4 and 13. Later a milky white shade along the subdorsal ridges, joining at the ends. Length, 1 to 1.5 mm.

Stage II.—Elliptical, flattened, dorsal space broad, level with the laterally extended horns; side area small. Horns 3, 4, 5, 8, 10, 12 and 13 short, tapering, as long as the width of the dorsum, those of joints 7, 9 and 11 very short, conic, less than half as thick and about one sixth as long as the others. Long horns with many fine, flexible, spinulose white hairs toward tip, but above and at base mixed with smooth straight setæ with dark tips. The short horns bend down and have only smooth setæ; the long horns are all equal. Color uniform translucent whitish green, in some with rounded brown dots on joints 4, 7 and 11 or 4, 7, 9 and 11 dorsally. The side area is covered by the subdorsal horns which are constricted a little at base, but are without separate basal pieces. Skin with clear setiferous granules as at maturity. The larva eats a channel in the leaf, in which it rests, the horns overlapping the uneaten leaf. Length, 1.5 to 3.1 mm. Duration of the stage 5 days.

Stage III.—Shape essentially as in the mature larva, the dorsal groove broad and shallow. Horns of joints 3 to 13 of even length except 7, 9 and 11 which are about half as long or a little over half as long as the others, thick, tapering, constricted near and at base, indicating the rounded basal pieces, but they are not furcate. Hair abundant, fine and spinulated as before with some smooth, dark tipped ones toward bases of horns; primitive setæ ii visible. Color all green, made whitish by the hairs. Skin as before. The horns are slenderer than before and look more numerous as those on the weak segments appear more distinctly. Length, 3.1 to 4.5 mm. Duration of the stage 5 days.

Stage IV.—Much the same. The short horns are now about nine-tenths the length of the others and during the stage they fill out and become almost completely indistinguishable. The hairs are almost all the spinulose ones, only a few of the smooth, black tipped ones remaining. Horns long and slender, a little swollen at base, the basal pieces constricted off and obscurely furcate. Setæ i and ii are distinct, on the basal piece and tip of horn respectively, smooth, dusky. Lateral horns minute, naked, tapering, enlarged at base and once constricted, concealed under the subdorsals. All green, usually no marks, sometimes with the dorsal red spots. The shade varies from leaf green to bluish

green. Head rounded, green with black ocellus and brown mandibles; width .8 mm. The horns are detachable as at maturity. Length, 4.5 to 7 mm.

Stage V.—Shape as in the mature larva, all the horns equal except joints 3 and 4 which are beginning to be a little shorter, that of 3 slightly recurved. Dorsal groove distinct, narrow; basal piece of horns distinct, cordate at base. Horns regularly tapering, rounded at tip, densely clothed with long, fine, white fringe-hairs. There are also some smooth, short, dark-tipped hairs and short, densely feathered, stellate ones especially toward the bases of the horns. Setæ i and ii long, smooth, black. Skin as at maturity. Color soft, clear green, more whitish along the dorsal groove. Nearly all the specimens (35) had lost the red spots at this stage, only one or two retaining them. Length, 7 to 10.5 mm.

Stage VI.—Mature larva. Length, 10.5 to 16.7 mm. The short smooth hairs on the horns represent the long smooth ones of the earlier stages; the short, very feathery hairs are those of the long feathery ones which lie on the dorsal aspect of the horns, made short. The larva here recorded probably omitted one of the normal stages. Probably the penultimate as in *Packardia geminata* (JOURN. N. Y. ENT. Soc. VI, 3).

It was kept very warm and was protected from the chill night air that it would have had on its native river. Consequently it grew very rapidly, probably more so than in nature.

Another larva reached 13.5 mm. before last molt which was doubtless this missing stage. It was like the final stage, but the coloration entirely green.

Food-plants. Add Marlberry (*Ardisia pickeringia*), cocoa plum (*Chrysobalanus icacoa*) and another plant not determined. I am indebted to Mr. F. Kinzel for the names and to Mrs. Slosson for sending leaves to feed the larvæ.

ON THE DIPTEROUS FAMILY SCATOPHAGIDÆ.

By D. W. COQUILLETT, Washington, D. C.

This family is known in Europe as Scatomyzidæ, but since the genus *Scatomyza* is an admitted synonym of *Scatophaga*, it would appear desirable to change the name of the family to Scatophagidæ. In the

Osten Sacken catalogue it bears the name of Cordyluridæ, but since the genus *Scatophaga* is the oldest one in this family, it is desirable to name the family after it.

The European genera and species of this family have quite recently been monographed by Mr. Theodore Becker,* and a translation of his tables of subfamilies and genera, in an abbreviated form, is given by Dr. Williston in his recent manual. Owing to the faulty definitions of the subfamilies, whereby certain genera which possess a given character are placed in a subfamily in which this character is expressly stated to be absent, and the further difficulty of separating subfamilies by such Walkerian phrases as "face short," "face long," it will be quite impossible for the student to refer his species to its proper genus by the use of these tables, and I have therefore constructed an entirely new one which contains all of the genera belonging to this family known to me to occur in this country.

TABLE OF GENERA.

1. Front tibiæ destitute of an erect black spine on the inner side of each near the apex 2
   Front tibiæ each bearing such a spine, third antennal joint rounded at the apex, palpi destitute of an unusually long bristle at apex of each, one sternopleural macrochæta .... **Acanthocnema** *Becker.*
2. Third antennal joint produced in the form of a tooth at the anterior apical angle .. 3
   Third joint rounded at the apex 5
3. With three sternopleural macrochætæ, palpi destitute of an unusually long bristle at apex of each .... **Orthochæta** *Becker.*
   With two sternopleurals, palpi near apex of each bearing a bristle which is nearly one-half as long as the palpi .... **Chætosa**, gen. nov.
   With only one sternopleural, palpi destitute of a single long terminal bristle 4
4. Palpi spatulate, about twice as long as wide .... **Spaziphora** *Rond.*
   Palpi more than four times as long as wide .... **Opsiomyia**, gen. nov.
5. Apex of palpi each bearing a single bristle which is nearly as long as the palpi, one sternopleural 6
   Apex of palpi destitute of such a bristle 7
6. Head at least as high as long, face nearly perpendicular ...... **Cordylura** *Fall.*
   Head flattened, noticeably longer than high, face very oblique, greatly retreating below .... **Acicephala**, gen. nov.
7. With only one sternopleural 8
   With two sternopleurals, frontal bristles strong, two or more pairs on anterior third of the front .... **Hexamitocera** *Becker.*
8. Frontal bristles strong, two or more pairs on anterior third of the front. **Scatophaga** *Meig.*
   Frontal bristles very short, none on lowest third of the front. **Hydromyza** *Fallen.*

* Berl. Ent. Zeitsch., May, 1894, pages 77 to 196.

DESCRIPTIONS OF NEW SPECIES, AND NOTES.

Scatophaga vulpina, sp. nov.

Black, the front except each side and an ocellar spot, face cheeks, first two antennal joints, arista, palpi, halteres and legs, yellowish, the bases of the front femora and a streak or more or less of the bases of the others, sometimes black; hairs of occiput, body and legs long and abundant, principally reddish-yellow, arista bare, humeral and dorso-central bristles except the posterior pair, very slender, scarcely distinguishable from the hairs, pteropleura bare, middle and hind femora destitute of stout macrochætæ, hind tibiæ each bearing only two, situated near the middle of the front side; wings strongly tinged with yellow, the small and posterior crossveins bordered with brown; body subopaque, gray pruinose, the thorax and pleura mottled with brown. Length, 8 to 11 mm.

Point Barrow, Alaska. Five males and five females collected June 22, 1882, by Mr. John Murdock. Type No. 4096, U. S. National Museum.

Scatophaga furcata *Say*.

This is one of the few species introduced from Europe and described in this country before it was described in Europe. The synonymy is: *squalida* Meig., *apicalis* Curtis, *nigricans* Macq., *fuscinervis* Zett., *pubescens* Walk., and *Cleigastra suisterei* Townsend; the latter based upon a co-type specimen.

Opsiomyia, gen. nov.

The characters of this genus may be gleaned from the following description of the type species:

Opsiomyia palpalis, sp. nov.

Head slightly broader than high, as long as high, slightly longer at base of antennæ than at the vibrissæ, seven pairs of orbital bristles which extend from the lowest ocellus to the anterior end of the front, clypeus connate with the face and extending more than the length of the second antennal joint below the vibrissæ, the latter almost twice as long as any of the adjacent bristles, lateral oral margin bearing black bristles on nearly its anterior half; third joint of antennæ twice as long as broad, slightly more than twice as long as the second, the anterior apical angle produced in the form of a tooth, arista bare, thickened on the basal third, the penultimate joint slightly longer than broad; proboscis robust, palpi greatly flattened, of nearly an equal width but tapering at the base, five times as long as broad, projecting four-fifths of its length beyond the oral margin, each bearing a single long, black bristle near the middle of the outer side, eyes oblique, slightly higher than long, bare. Bristly hairs of body short and sparse, five dorso-central macrochætæ, one sternopleural and four stout scutellar, none on the abdomen, all femora and tibiæ bearing several, hind tibiæ each with two pairs on the outer side besides those near the tip. Venation practically as in *Cordylura*, all veins bare. Black, the extreme

base of palpi yellow, remainder white, halteres, femora, tibiæ and tarsi yellowish, wings hyaline; face silvery white, body brownish gray pruinose. Length, 5 mm.

White Mts., N. H. Two males collected by the late H. K. Morrison. Type No. 4097.

Chætosa, gen. nov.

The type species is *Cordylura punctipes* Meig., of which the National Museum possesses two specimens from Minnesota, one from Colorado and two from Holland. This species could never be identified by the use of Becker's monograph, since he places it in the genus *Trichopalpus*, to which, both in the table of genera and in the definition of the genus, he attributes a single sternopleural macrochæta. The palpi are sub-lanceolate, slightly flattened, and at the apex of each is a black bristle which is much longer than any of the adjacent ones.

Acicephala, gen. nov.

Closely related to *Cordylura* but readily distinguishable by the elongated, flattened head and very oblique face. Type, the following species:

Acicephala polita, sp. nov.

Black, the face, cheeks, palpi, halteres, coxæ, femora, tibiæ and tarsi, yellowish; front, except the ocellar triangle, inner side and apex of second antennal joint, face, cheeks and pleura white pruinose, the occiput, mesonotum, scutellum and abdomen, polished; second joint of antennæ prolonged over the inner side of the first nearly to the arista, the third joint two and one-half times as long as broad, only slightly longer than the second, arista rather long plumose, thickened on the basal fifth, the penultimate joint broader than long; eyes bare, nearly perpendicular, only slightly higher than long; vibrissæ more than twice as long as the adjoining bristles, lateral oral margin bearing three or four black bristles on its anterior half; palpi clavate, slightly flattened, bearing several long yellowish bristles near the middle, a few short black ones at the tip besides one which is nearly as long as the palpi; proboscis robust, only slightly over twice as long as thick. Mesonotum almost destitute of bristly hairs, five stout dorso-central macrochætæ, one prothoracic, one sternopleural, and two on the scutellum; abdomen less polished than the mesonotum, destitute of stout macrochætæ, its hairs black, those on the venter except at the apex, whitish. Wings hyaline, tinged with brown along the veins, third and fourth veins toward their apices parallel, the fourth ending far beyond the apex of the second, small crossvein beyond the middle of the discal cell, and far beyond the tip of the first vein, all veins bare. All femora and tibiæ bearing macrochætæ, hind tibiæ each bearing three pairs on the outer side beside those at the tip. Length, 7 to 8 mm.

Colorado. One male and three females. Type No. 4098.

Acicephala pilosella, sp. nov.

Same as the above description of *polita* with these exceptions: Face, cheeks, palpi, coxæ and femora black; pruinosity of front, face, cheeks, and pleura, brownish

gray and not dense, none on the second antennal joint, mesonotum sparsely covered with short yellow hairs, only one pair of dorso-centrals, the prothoracic bristle yellow, hairs of the first three segments of the abdomen in the male, of the first six in the female, yellow, apex of sixth segment in the female bearing six stout macrochætæ. Wings not tinged with brown along the veins. Hind tibiæ each bearing only two pairs of macrochætæ on the outer side. Length, 6 to 7 mm.

Colorado, and Reno, Nevada (H. F. Wickham). One male and two females. Type No. 5002.

Cordylura nebulosa, sp. nov.

Black, the front except the sides and the ocellar triangle, dark brownish yellow, sides of front, face, cheeks, lower part of occiput and the palpi, white, first two antennal joints, proboscis, halteres, coxæ, femora, tibiæ and tarsi yellow; third antennal joint one and one-third times as long as wide, arista short pubescent, vibrissæ short, yellow, a yellow bristle of nearly the same length below each. Mesonotum and scutellum opaque gray pruinose, five dorso-central macrochætæ, scutellum bearing four stout ones; pleura on the lower part gray pruinose, the upper part and the abdomen polished, the latter destitute of stout macrochætæ, its hairs yellow. All femora and tibiæ bearing stout macrochætæ, hind tibiæ each with three on the outer side besides those at the tip. Wings hyaline, the costal cell beyond the humeral crossvein, a border to the first vein beyond base of the second, and a large spot extending from apex of first vein to slightly beyond the apex of the fourth, brown, sometimes a hyaline vitta in the marginal cell, a triangular hyaline spot near apex of the submarginal and first posterior cells; small crossvein near last third of the discal cell. Length, 5 mm.

Algonquin, Ill. Two female specimens collected June 2 and 6, 1895, by Dr. W. A. Nason. Type No. 4099.

Cordylura slossonæ, sp. nov.

Black, the lower half of the front, antennæ, face, cheeks, lower part of occiput, palpi, proboscis, under side of the prothorax, halteres, apical lamellæ of the genitalia, coxæ, except a spot on the outer sides of the middle and hind ones, femora except apices of the middle and hind ones, tibiæ and tarsi, yellow. Third antennal joint one or two-thirds times as long as wide, arista long plumose on the basal half, thickened on the basal sixth, lateral oral margin ciliate with yellow bristly hairs. Mesonotum, scutellum and abdomen polished, sparsely covered with yellow hairs, one pair of dorso-central and scutellar macrochætæ, abdomen destitute of stout macrochætæ except at apex of the sixth segment; pleura gray pruinose, one sternopleural macrochætæ, those of the prothorax and mesopleura slender and yellow. Front and hind femora destitute of stout macrochætæ, those of the front tibiæ slender and yellow, under sides of femora and inner sides of tibiæ thickly covered with long yellow hairs. Wings hyaline, small crossvein near last third of the discal cell. Length, 7 mm.

Mt. Washington (Mrs. A. T. Slosson) and White Mountains (H. K. Morrison), N. H., and Beverly, Mass. (Edw. Burgess). Four male specimens. Type No. 5000.

Hexamitocera vittata, sp. nov.

Head yellow, an oblong ocellar spot and a wide stripe extending from the upper part of each eye to the neck, dark brown; antennæ brown, the first two joints and base of the third yellow, third joint two and one-half times as long as broad, arista pubescent, palpi and proboscis yellow. Thorax yellow, the mesonotum, scutellum, metanotum and a vitta beneath each wing, dark brown, polished, the mesonotum marked with four yellow vittæ; two pairs of dorso-centrals, one pair of scutellar, two prothoracic and two stenopleural macrochætæ. Abdomen polished, dark brown, the hypopygium and the posterior margin of each segment, except the first, yellow, the hairs black, a few macrochætæ along the sides. Legs yellow, front and middle femora ciliate on the under sides with black bristles. Wings grayish hyaline, small crossvein slightly beyond middle of discal cell. Length, 6 mm.

Colorado. A male specimen. Type No. 5001.

COCCIDÆ COLLECTED IN MEXICO BY MESSRS. TOWNSEND AND KOEBELE IN 1897.

BY C. H. TYLER TOWNSEND AND T. D. A. COCKERELL.

The following are species jointly studied by us (with certain exceptions duly noted) in working over the two lots of coccid material collected in Mexico by Messrs. Townsend and Koebele during 1897, which were sent to us for determination by the United States Department of Agriculture. An author's initials, bracketed at the end of a species, mean that the entire text under that species is to be accredited to that author alone. The work of mounting the specimens, drawing up the descriptions, and finally of preparing and writing the entire manuscript, was done by Mr. Townsend. Some notes on the forms of *Icerya purchasi*, based on material not represented in the above two lots, and also the description of a Brazilian species of *Capulinia*, are included in the paper, having developed in connection with the study of the other material.

Icerya purchasi *Mask.*

Typical form (= *crawi* Ckll.).—On citrus trees in Magdalena, Sonora, Sept., 1894 (Townsend). Thriving colonies of the typical *purchasi* were found here, and must have been introduced from California. This, however, is so far the only authentic recorded locality for typical *purchasi* in Mexico. (See remarks under var. *maskelli* which follows.) [C. H. T. T.]

Icerya purchasi var. **maskelli** *Ckll.*

On trunks of several orange trees at Aranjuez, six miles from Guaymas, Sonora, Sept. 23, 1894 (Townsend).* This is the form that I took at Guaymas, and which has been published as *purchasi.* The specimens are noticeable for their small size and short subconic ovisacs.

The larval characters of *purchasi* (typical form) and var. *maskelli* do not differ appreciably except in the antennæ of first stage, and this difference is not apparently constant. Mounts were made of larvæ of *purchasi* (typ. form) from California and Magdalena, Sonora; and of var. *maskelli* from California and Guaymas, Sonora. The two mounts from California and that from Magdalena show the antennæ of first larval stage practically the same; *i. e.*, the last joint is irregular in outline, and the penultimate, as well as last joint, bears one or two of the very long hairs. The Guaymas mount, being from the present specimens, shows the last antennal joint of first larval stage almost uniformly to be rather swollen and regular in outline, well constricted at base, rather soda-bottle shaped, and with none of the long hairs on penultimate joint. But some specimens occurred exhibiting a tendency toward the other form, so that the character can hardly be called distinctive.

The difference between the typical *purchasi* and var. *maskelli* were pointed out by Cockerell in Psyche, July, 1897, under the heading "note on two forms of the fluted scale." These forms were recognized by Craw some seven years ago as differing from each other, and have ever since been noticed by him to retain their distinctive features. The finding of the present specimens, which seem to be an exaggerated *maskelli* form, near Guaymas, Sonora, suggested the possibility that *maskelli* might represent an endemic American form, not in any way connected with the Australian *purchasi.* This supposition fell after making an extended examination of the larvæ, which could not be satisfactorily separated (at least the Californian specimens could not), so that the two forms could hardly be natives of two widely separated countries. It is still possible, however, that the present specimens from Guaymas may represent an endemic form related to *purchasi*, and thus a new species, but I do not consider it probable.

The statement of Cockerell (Psyche, l. c.) that *maskelli* is *purchasi* in the strict sense, and agrees very nearly with Maskell's description,

*These specimens were in all probability what I collected near Guaymas, but unfortunately they were sent out from the Department without label. I can state positively that I collected exactly similar specimens, so far as external appearance goes at the locality given.—C. H. T. T.

needs correction. It is *crawi* which agrees very perfectly with Maskell's description, and *maskelli* agrees very poorly. A photograph taken by Craw, in San Francisco, of Californian specimens of the two forms side by side, in situ on the branches, shows the differential characters very clearly. *I. purchasi* has the body covered, usually conspicuously, with a white or yellowish mealy secretion; the ovisac long, stout and subcylindric, the whole form of sac and insect robust; the edges of body with curled cottony filaments often of some length and pronounced, and the long glassy filaments normally present and conspicuous. *I. maskelli*, on the other hand, has the body usually nearly bare, dark in color; the ovisac short rounded subconic, being very conspicuously abbreviated compared with *purchasi;* the whole form much less robust, the edges of the body quite destitute of curled cottony filaments, and the long glassy filaments usually inconspicuous. [C. H. T. T.]

Icerya montserratensis *Riley and Howard.*

On leaves of avocado pear, Tampico, Jan. 26, 1897 (Townsend). Div. Ent., No. 4708. Only one adult ♀, but many young.

Icerya palmeri *Riley and Howard.*

One adult ♀, on *Coursetia* sp.,* near Guaymas, Sonora, April 23, 1897 (Koebele, 1714), Div. Ent., No. 7893. This is the first and only adult specimen of *I. palmeri* known. As the specimen is an unique, it was decided not to boil it for a study of the adult ♀ anatomical characters. Unfortunately the antennæ were broken, so that it is impossible to say whether it possesses 9-jointed or 11-jointed antennæ, and therefore it can not yet be referred to its proper subgenus.

Length of scale including ovisac, over 11 mm. Greatest width of body and of ovisac, 5 mm. Width of ovisac at extremity, 4 mm. Height of insect, 4 mm.; of ovisac, 4½ mm.

Adult ♀. Body red; legs and antennæ black, covered as well as venter with a white mealy secretion. Edge of body with moderately long curled filaments of white secretion, a central dorsal patch of filamentous secretion being variegated with pale sulphur-yellow. No glassy filaments on body apparently.

Ovisac pure white, not fluted, presenting a smooth lime-like surface, large and stout, 8 mm. long below and 7 mm. above. The species resembles *rileyi* in its smooth unfluted ovisac.

Several larvæ extracted from the ovisac demonstrated the fact of this species being *palmeri*. The median constriction of last antennal joint of first larval stage is pronounced and seems a constant character. The

* The name was spelled *Cocersitia* on label. Presumably *Coursetia* was intended.

wax of first and second larval stages is pure white. The characters agree perfectly with Riley and Howard's description. A specimen of the second stage of ♀ larva was also obtained from within the ovisac, and shows two long hairs, a little shorter than width of body, sticking straight out from sides of body, well removed from each other. These were doubtless broken off from the dried cast larval skins, from which the original description and drawings were made. The several hairs on last antennal joint of first larval stage are somewhat longer in some cases than in the figure. The broken stumps of the pair of cephalic hairs between bases of antennæ appear in one specimen, but do not show in the others. [C. H. T. T.]

Icerya rosæ *Riley and Howard.*

Seven ♀ specimens, all apparently adult, taken on bark of trunk of a tree which may have been *Prosopis* sp., in plaza at market place. Tehuantepec City, Oaxaca, May 26, 1896 (Townsend). Div. Ent., No. 7222. It is curious to note that the anatomical characters of the adult ♀ of *rosæ* are the same as those of *purchasi;* the antennæ of *rosæ* have been stated by Riley and Howard to be the same as *purchasi,* while an examination of the present specimens shows them to agree perfectly in all the other anatomical characters with the description of *purchasi* given by Comstock. The validity of *rosæ* stands on the absence of ovisac, absence of curled filaments of secretion on border of body, and absence of fine glassy filaments on body. Boiling in caustic soda gives first a pronounced rose-color, then a rose-brown.

Icerya littoralis *Ckll.*

One adult ♀ on bark of tree which may have been *Prosopis* sp., in plaza at market, Tehuantepec City, Oaxaca, May 26, 1896 (Townsend). Div. Ent., No. 7222. The egg sac is short, and is distinctly yellow on circumference of basal half. There is no sign of the fine glassy filaments of the body in this species. The fluffy waxy secretion enveloping the eggs and newly-hatched young is whitish, but the inside of the wall of egg-sac shows conspicuously yellow. The wax of first stage of larva is apparently quite pure white. The last antennal joint of first larval stage, taken from ovisac of present specimen, and from sacs of *littoralis* typical form, shows a slight constriction in middle, thus exhibiting a tendency toward *palmeri.* The first larval stage of *littoralis* has the third antennal joint uniformly the same as 1, 2 and 4, the approximate formula being 6 (1234) 5; while *palmeri* has the third joint uniformly longer than 1, 2 and 4, the formula being 63 (124) 5. The

antennæ of first larval stage of *littoralis* var. *mimosæ* Ckll., differ from typical *littoralis* in the more uniformly stout basal joints and stout last joint, the intermediate joints being narrowed, giving the antennæ a constricted appearance in the middle. In typical *littoralis* the basal joints seem nearly as narrowed as the intermediate ones. Both the typical form and var. *mimosæ* have the last antennal joint of first larval stage with several (about 3) very long hairs. Both also have the lateral bristles of border of abdomen anterior to anal bristles, in first larval stage, well differentiated from other lateral hairs, thus falling in the group with *rosæ*, *montserratensis* and *palmeri*.

The antennæ of adult ♀ were both broken, one showing nine joints, the ninth joint being fractured and the distal portion missing. But the identity of the newly hatched larva with that of *littoralis* proves the determination beyond doubt.

Ortonia primitiva, sp. nov. *Towns.*

Differs from *O. mexicanorum* Ckll. as follows: Antennæ only 9 jointed, less than twice as long as femur plus trochanter, more than twice as long as femur alone, the first five joints being about equal in length to the femur plus trochanter. Approximate antennal formula, (39) (21) (678) (45). Ninth is not as long as seventh and eighth together. The only joints that are broader than long are 1, 2, 4 and 5. Joints 3, 6, 7 and 8 are about as broad as long. In some cases 8 seems a little longer than 6 and 7. The last three joints are approximately equal in width, while the other joints gradually narrow proceeding toward the base. Joint 1 is perhaps ⅓ wider than 2. Tibia more than ¼ longer than femur, and but little more than ⅓ as broad as femur, being rather slim. Tarsus (not including claw) about ½ length of tibia, with about seven spines in a line on inner edge, tibia with about ten such spines. Claw apparently with a short stout rudimentary digitule. Under and outer edge of claw on each side delicately scalloped, showing four scallops. No bristles apparent on claw. Integument showing the large round and oval hyaline spaces said to be characteristic of the genus, and thickly covered everywhere with numerous long strong spines interspersed with shorter ones. Boiling in KHO stains the liquid brown. Length of ♀ after boiling, about 5 or 6 mm.; dried unboiled ones are 3 mm. long, by 2 mm. wide. One of the larger specimens is accompanied by a considerable amount of pure white, fluffy, cottony secretion, which may form a substitute for an ovisac in this species. This cottony secretion, which does not seem to be present in *mexicanorum*, together with the presence in the debris of small orange-colored eggs, indicates that the material is adult.

This species and *mexicanorum* need the erection of a separate subgenus for their reception, perhaps two subgenera. I propose the name *Protortonia* for the present species, and it may even be found to merit generic rank, as being quite distinct from *Ortonia*. For the present, *O. mexicanorum* can be included in it also.

On "nettle tree," Cuantla, Morelos, May 31, 1897 (Koebele). Div. Ent., No. 7878. The nettle tree, as stated elsewhere in this paper, is probably *Manihot* sp. [C. H. T. T.]

Cerococcus corticis, sp. nov.

Adult ♀. Elongate-globular, balloon-shaped, apodous and without antennæ, integument whitish and transparent after boiling; anal cone chitinous, yellowish at base, brownish on terminal margins, wide and stout, conico-cylindric, about as long as basal width, less in diameter at discal end than at base, the margin deeply notched on ventral and dorsal aspect, the notch reaching to about middle of length of cone, the margins with a row of strong bristly hairs curved at ends, the lateral lips externally rather thickly clothed with the same extending down about ¼ way to base of cone. Between bases of lateral lips of cone inside appears what is evidently a median tubercle though not distinct, corresponding to the median tubercle situated between the two elongate caudal tubercles of *C. quercus* Comst. Anal ring concealed, but the stout, long cylindriform hairs arising from it are conspicuous, six in number (3 pairs), and reach well beyond ends of lateral lips of cone. In a younger specimen these hairs reach fully as far beyond ends of lips as depth of notch of anal cone. In a still younger specimen they are not apparent at all. The clear light yellow surface of basal part of cone shows a pair of brownish spots on either side, the inner pair much the larger. Spiracles distinct. Mouth parts large and well-developed; ♀ full of large well-developed ova. Length of ♀ on slide, nearly 2 mm.; width, 1⅜ mm.

♀ Scale white, irregularly oval in form, seed-shaped or bead-shaped, covered wholly with a waxy secretion which has a felted, sometimes cottony, appearance on the surface. Length, 2 to 2½ mm.; width, about 1⅜ mm.; thickness, about 1 to 1¼ mm. Apparently stuck into the surface of the rough bark.

On bark of *Quercus engelmanni*, Nogales, Sonora, April, 1897 (Koebele). Div. Ent., No. 7880. Professor Cockerell had determined this species rather hastily as *C. ehrhorni*, and Mr. Pergande called attention to the fact that it was very different in appearance and must be distinct. As will be seen, the anal characters show the species to be very distinct from *ehrhorni*. It will be well also to note the very marked difference between *corticis* and *quercus* in the anal characters, as shown in Comstock's figure of the latter.

Phenacoccus gossypii, sp. nov.

Sac pure lime white; length, 5 to 6½ mm.; width, 2 to 2½ mm.; parallel-sided, more widened, larger and stouter than in *helianthi*, and the body of ♀ not apparent at one end, the sac wholly covering the body. Boiling in caustic soda does not stain the liquid.

Adult ♀. Length of body, 3 mm. Approximate antennal formula 2 (39) (145678). The antennæ and legs are practically the same as in *helianthi*. The digitules of the claw are distinct, rather slender, well knobbed, and extending beyond the end of the claw about ¼ the length of the latter. Antennæ and legs pale brown.

This species may be considered as taking the place in tropical Mexico of *helianthi*, which is found in northern Mexico, Texas and New Mexico. While *helianthi* affects *Helianthus*, *Pluchea*, etc., in the temperate region just named, *gossypii* affects cotton and other malvaceous plants in the tropical region to the south. Probably the specimens found by Townsend on cotton at Santa Maria, Texas, May 7, 1895, and identified by Tinsley as *helianthi* var., are nearly or quite the same as the present form.

P. helianthi and *gossypii* both differ from *yuccæ*, the only other described Mexican *Phenacoccus* in lacking the characteristic dark coloring of the antennæ and legs. They may be separated from each other by the sac characters already given.

Massed on stems, stalks and leaves, mostly on underside of latter at base of cultivated ornamental plant called, "amistad," which is very closely allied to cotton and is probably a species of *Gossypium*. Frontera, Tabasco, June, 1897 (Townsend). Div. Ent., No. 7820.

Also specimens on twigs, leaves and squares of cotton, Frontera, Tabasco, June, 1897 (Townsend). Div. Ent., No. 7811. From this material only a single adult ♀ was obtained. It agrees in every respect with the specimens from amistad, except that the second and third antennal joints are equal in length. Only the first six of the antennal joints are represented in the specimen; the formula for these would be (23) 1 (456). The sacs are typical.

Var. *a*.—Sacs have same general characteristics and appearance, but are uniformly smaller than in typical *gossypii*. Length of sac, 3 to 5 mm.; width 1½ to 2 mm. The legs, including digitules of claw, are same as in *gossypii*. So also are the other characters of the ♀, except only those of the antennæ, the second and third joints of which are normally quite equal; the approximate antennal formula is 23 (19) (45678).

Greatly massed on branches, twigs, stems, and leaves of *Mimosa* sp., called "sarsa," Las Islas del Rio Usumacinta, some 20 miles or more above Frontera, Tabasco, July 9, 1897 (Townsend). Div. Ent., No. 7281. The plants were growing on the edge of the river, and were partially submerged at the time by the high water.

Subsequently to writing the above, Professor Tinsley has carefully studied these forms of *gossypii*, and compared them with *helianthi*. His investigation convinces him that no antennal or other structural character of the adult ♀ will serve to differentiate *helianthi* and *gossypii*. The easily noticeable differences in external appearance are, however, sufficient to separate them.

Prosopophora manihotis, sp. nov.

♀. Scale suborbicular, averaging about 3 mm. long, by 2½ mm. wide, and 1¼ to 1½ mm. high. Color sordid yellowish-white or brownish-gray. Surface rugose near margin, dorsal surface faintly transversely ribbed, three longitudinal rows of slight tubercles more or less distinct; in some specimens the dorsal surface is worn smooth. Scale with conspicuous traces of a whitish chalky secretion. Boiled in KHO gives the liquid a reddish or brownish color. The dried females under the scales are black.

♀. Antennæ 8-jointed, moderately stout, gently tapering; first joint about twice as wide as long, second a little wider than long, third a little longer than wide, second and third about equal in width and considerably narrower than first; fourth considerably narrower than third, about half again as long as wide; fifth still narrower but not twice as long as wide; sixth shorter than fifth, and seventh shorter than sixth, seventh being slightly wider than long; eighth joint knob-like, circular in outline, surmounted by several hairs, diameter less than width of seventh. Usual antennal formula approximately (34) 5 (612) (78); varying in one case to (34) (512) 6 (78).

Spines of integument large, long and sharp. Double glands of integument not of the usual figure-eight form, but bent half double, thus presenting the outline of a pair of short ears. The integument shows the rod-like structures very numerous and rather stout, the whole surface being covered with them.

On bark of "nettle tree" (so called on label), Cuantla, Morelos, May 31, 1897 (Kœbele 1757). Div. Ent., No. 7910. As there is no other possible plant in the tropics of Mexico, so far as I know, which could be called a nettle tree, other than what is known as the "mala mujer," which is a species of *Manihot* (or *Jatropha*), I take it that this is the plant in question. It especially merits the name of nettle, and assumes tree-like dimensions. Its spines are extremely irritating if only barely touched to the skin. The bark on which the scales occur resembles perfectly that of this giant nettle. [C. H. T. T.]

Tachardia nigra, sp. nov.

Single specimens show the lac to be disposed in a more or less stellate form covering the body of the female, the stellate shape being due to the similar shape of the body of the female. Usually, however, the specimens are massed together on the branches, being so close to each other that the lac becomes confluent, joining the specimens and presenting the form of irregular elongate globular masses more or less confluent. The lac usually has a decided blackish surface color, unlike any hitherto known species of the genus; it varies to dark brown in some cases, however. Average diameter of single specimens covered with lac, 3 to 4 mm.; height, 2 to 2½ mm. Boiling the lac in KHO gives a dark crimson lake color.

♀. Spine is very long and thorn-shaped, perfectly regular in outline, widened at base, gradually tapering from near base to point, in length probably more than four times extreme basal width (the point in specimen studied is broken off). Perforated

plate of lac-tube subcircular; group of glands elongate-oval, widened end of group contiguous to border of plate; glands oval, closely packed. Anal tubercle prolonged at sides into long spine-like processes only a little shorter than width of tubercle at their origin, and longer apparently than the caudal filaments which are to be seen between them. The specimens are evidently adult. The lac of young specimens is disposed in a perfect star-like form, and the color is reddish-brown.

On branches of *Acacia* sp., Orizaba, Vera Cruz State, July 15, 1897. (Koeble 1721). Div. Ent., No. 7927.

Tachardia mexicana *Comst.*

Lac in color reddish-brown, shaded to reddish-yellow.

♀. Antennæ 6-jointed, formula (23) 4 (15) 6, stout, outwardly bowed, nearly equal in width throughout, first joint a little wider than rest; sixth joint narrowest, rounded, very short; second and third about as long as wide.

On branches of *Mimosa* sp., Oaxaca, Oaxaca State, August 21, 1897. (Koebele 1664). Div. Ent., No. 871. [C. H. T. T.]

Capulinia sallei *Sign.*

Adult ♀. Antennæ very short, atrophied, represented by a mere tubercle, not as high as broad, surmounted by several (about 4 to 6) hairs, not chitinous. Mouth parts large and well developed. Legs atrophied, front and middle pairs represented by a sharp conical stump, chitinous, triangular in outline, but little longer than basal width, usually distinctly 3-jointed, the third joint point-like. Hind legs nearly twice as long as others, of same structure, form and outline, except that they are nearly twice as long as basal width. The two stigmata on each side of body distinct, chitinous. Anogenital ring small, chitinized on its edge, without hairs; the integument thickly clothed all around it, within a radius of 8 to 10 times diameter of chitinous portion of ring, with what appear like short hairs but are probably minute elongate glands or tubular spinnerets, giving the area a thickly dotted appearance which ends abruptly. The specimens studied, after being boiled, measure 1½ to 1⅔ mm. in diameter. They boiled clear easily. Boiled in KHO stains liquid greenish-yellow.

♂. What is apparently the male scale is creamy-white, cottony but of close texture, entirely covering the immature male, subquadrangular in dorsal outline, a little flattened, and 1½ to nearly 2 mm. long, by ⅗ to ⅘ mm. wide. An immature male pupa shows a broad stout chitinous anal horn, twice as long as width at origin, rather bluntly pointed, triangular in outline, and with a long strong chitinous spine approximated to it underneath, taking its origin on ventral surface at a distance anterad of origin of anal horn equal to fully or a little more than the length of latter, the point of spine reaching beyond the middle of length of latter and parallel with it. The legs are well developed; femora, tibiæ and tarsi rather swollen, coxæ and trochanters narrowed, the femora thinly and the tibiæ and tarsi more thickly clothed with minute bristles, the tarsi with a well-formed claw at end. Femur plus trochanter distinctly shorter than tibia plus tarsus. The long many-jointed antennæ do not show the segmentation distinctly enough to be described. The length of the pupa, as mounted, is 1½ mm.

I have no doubt that this is Signoret's species. Not only do the

adult ♀ characters agree perfectly, as figured and described by Signoret, but the description of the appearance of the adult ♀'s in life, in situ on the food plant, agrees perfectly, the ♀ being covered with a cottony secretion and bearing pendant from the oval end a single long cottony filament.

Found on leaves and twigs of a wild shrub or small tree called "escobillo," in woods, Arroyo San Isidro (near Frontera), Tobasco, May 27, 1897 (Townsend). Div. Ent., No. 7659. The cottony filaments hanging pendant from the ♀'s reached a length of something like three inches.

This rediscovery of *Capulinia sallei* is of great interest, not only *per se*, but further as throwing much light on the affinities of several more recently described allied genera. The study of the present material has demonstrated the close relationship of *Capulinia* with *Sphærococcus* Mask. (1891), and *Xylococcus* Loew (1882). Both *Capulinia* and *Xylococcus* fall in the *Idiococcinæ* of Maskell, and in fact could both be included in the genus *Sphærococcus* as characterized by that author. However, the genus *Sphærococcus* may be maintained for forms of the *S. casuarinæ* Mask. and *acaciæ* Mask. type, while *S. inflatipes* Mask. needs the erection of a separate genus for its reception. *S. bambusæ* Mask. has already been referred to *Antonina*. Other species described since by Maskell as *Sphærococcus* will need similar revision. *Xylococcus filiferus* Lw. of Austria, resembles *Capulinia sallei* in the presence of the long pendant cottony filament of ♀, but apparently differs in the presence of an anal cone and other minor characters. The genus *Sphærococcus*, as above restricted, will include such forms as have the feet entirely absent in the adult ♀, and the antennæ either absent or rudimentary. *Capulinia* will include forms in which not only the antennæ, but also the feet, at least the posterior pair, are represented in more or less rudimentary form, and are not entirely absent. While both the feet and antennæ are said by Loew to be wanting in *Xylococcus*, the latter genus will remain distinct from *Sphærococcus* by its chitinous anal cone or tubercle. [C. H. T. T.]

The description of the following Brazilian species is included here while on this genus:

Capulinia jaboticabæ Von Jhering.*

Adult ♀. Round-oval in outline, ⅘ to 1 mm. in length. Differs from *C. sallei* as follows: Antennæ more developed but still rudimentary, about twice as long as

* We had named this species after Dr. Von Jhering, but in the meanwhile he has (Revista Agricola, June 1898, p. 188) proposed to call it *Capulinia jaboticabæ*. Dr

wide, distinctly 4-jointed, joints 1 to 3 more than twice as wide as long, last joint narrower and irregular with several hairs. Another specimen, probably of a previous moult, shows five joints in the antennæ. Front and middle pairs of feet entirely absent, without tubercular rudiments. Hind legs quite well developed, distinctly segmented, not tubercular but elongate; coxa subtriangular, as long as basal width, wide; femur (plus the small trochanter) wide, but only about two-thirds as wide as base of coxa, about as long as length of coxa; tibia narrower and a little longer than femur; tarsus tapering, fully as long as tibia, without apparent claw. In the immature specimen above mentioned the femora are relatively wider compared with the coxæ.

Brazil, probably Sao Paulo (Dr. H. von Jhering). On *Myrciaria cauliflora*. This is a very distinct species from *C. sallei*, in the complete absence of front and middle legs, and the comparatively well developed hind legs.

Lichtensia mimosæ, sp. nov.

Length of shrunken ♀, 3½ mm.; of ovisac, 12 to 13 mm. Width of ovisac, 4 to 4½ mm. Ovisac white, compact, surface with a satiny lustre, nearly parallel-sided, not ribbed or keeled, normally covering the insect.

Antennæ rather short, eight-jointed, without noticeable hairs except what appear to be two short ones at tip, second joint considerably shorter than third which is longest, fourth and fifth nearly equal and shorter than third, sixth about as long as second, seventh and eighth but little shorter. Approximate antennal formula 3 (45) (26) (78) 1. Tarsal digitules very long, slender, more than twice as long as the claw, not greatly knobbed. Digitules of the claw very stout, one quite equally thickened and not greatly widened at end, while the other is narrowed in the middle and club like at end. Claw digitules as long as the claw, which is rather large. Tarsus a little more than one-third length of tibia; femur markedly longer than tibia. Anal plates together forming a square, the outline of each being a right-angled triangle, each with two short hairs at posterior end. Integument with numerous oval or usually nearly spherical glands, the smaller ones so massed as to give a finely granulated appearance. Marginal spines small and simple, but fairly stout, about or hardly as far apart as their length.

As compared with *Lichtensia lutea* Ckll., from Vera Cruz on *Croton* being the only previously known tropical Mexican *Lichtensia*, the present species differs markedly in the claw digitules, besides having the ovisac pure white instead of lemon-yellow. In *L. lutea* the claw is smaller, and the digitules of the claw are about twice as long as the latter.

Occurring singly on branches of *Mimosa* sp., locally called "sarsa," Las Minas, near Frontera, Tabasco, June 4, 1897 (Townsend). Div. Ent., No. 7810.

Noack has also sent me some specimens *in situ*, collected by Dr. Campos Novaes at Itatiba, State of St. Paulo, and I find they live in little crater-shaped galls. The females have the antennæ with 5 or 6 segments.—T. D. A. C.

Ctenochiton aztecus, sp. nov.

Length of ♀ scale, 2 to 2½ mm.; width, 1½ to 2 mm.; height, 1 mm. or a little less; in form convex, and leaving a very conspicuous white silk-like covering on the bark when detached. Boiling in KHO gives a pale brown color. The secretion of ♀ is glassy in appearance, and has the characteristic serrate frings on the edge. The marginal fringe shows 12 to 15 short teeth on each side. The adult ♀, after being denuded of the glassy secretion, is brown, but loses its color by boiling in KHO, except the anal plates and adjacent edges of cleft which remain brown. Integument shows a reticulated or honeycombed structure. Female apparently apodous and without antennæ. Marginal bristles extremely short, stout, and pointed, about as far apart as twice their length, but varying. Anal plates triangular, taken together hardly or nearly forming a square. Anal cleft deep, in some about one-fifth the length of whole body, in others less. Two bristles at end of each anal plate, and one on inner edge. Two longer bristles springing from their junction inside. The females are full of larvæ.

Glassy secretion is minutely irregularly striate, but shows no distinct air cells; it is raised on the dorsal surface into tubercular processes, showing especially in the more immature individuals. In the latter the processes take the form of a median dorsal row, a marginal row, and a row on each side half way between the dorsal and marginal.

On bark of trunk of tree called "cafetilla cimarron," which means wild coffee, but the tree is very distinct from coffee. Arroyo San Isidro, near Frontera, Tabasco, May 27, 1897 (Townsend). Div. Ent., No. 7645.

Ceroplastes roseatus, sp. nov.

♀ scale. Greatest length, 11 mm.; greatest width, 8 mm.; height, 6 mm. Color pale sordid yellowish, with a very faint rose tinge. Younger (smaller) specimens measure 7 to 9 or 10 mm. in length, and show the wax clearer, whitish with a pronounced roseate tinge or blush. Wax not divided into plates, no nuclei present. Form in lateral profile low conical with the apex rounded, the two sides meeting at a little more than a right angle; in anterior profile the sides meet at less than a right angle. The younger more roseate scales, with the fresh appearance to the wax, are not so symmetrically formed, the anterior margin of the wax being lapped up in front, and presenting just posterior to this a deep notch in the profile. Median dorsal tubercle of the wax is pale yellowish. Margin a little scalloped in dorsal profile, showing about seven projections of the border. Thickness of wax at base, 3 mm. at ends, averaging 2 mm. at sides. Surface of wax smooth, a little roughened in the largest specimens.

Body of ♀, before being boiled, denuded of wax (basal measurements), 4 mm. long, 2½ mm. wide; this being a specimen which measured 9½ mm. in length with wax in situ. Dorsal tubercle prominent, high, narrow, but widened (or rather lengthened) longitudinally, the sides giving the outline in lateral profile of a perfect angle of 55 degrees. Sides of body showing seven distinct lateral tubercles, the anterior one being in the middle. Caudal horn very elongate and stout, about 2 mm. long, and ⅘ mm. in diameter at base. Color of dorsum brownish-red, the caudal horn black, becoming brown at base. Boiling in KHO gives a faint rosy tinge.

♀. Capitate spines of integument present same form as in *ceriferus*. Claw short, digitules of claw about twice as long as claw, unequal, one very stout and that knob extremely large, the other more slender and widened or flattened leaf like at end. Femur rather stout, swollen, rather long oval in outline, without the trochanter about as long as tibia; tibia about one third as wide, parallel-sided. Tarsus a little more than half as long as tibia. Tarsal digitules filiform, well knobbed at end, reaching a little farther than to the ends of claw digitules. Antennæ 6-jointed, the last three joints nearly equal in length, the sixth slightly longest, the third very long and a little wider than the following ones; the first and second about equal and each less than or about one-third as long as the third. The fourth and fifth are about one-half again as long as wide; the first is somewhat wider than length of second; the second is truncate-conical, its basal width being about equal to its length, its distal width a little more than one-half its basal.

The only other known roseate forms of *Ceroplastes* are, a variety of *floridensis*, which is easily distinguished by its much smaller size; and *albolineatis*, which was described from Jamaica, and is a very common species in Brazil, but is at once distinguished by the two conspicuous white lines on the sides.

On branches of a wild fruit tree locally called "cojon de venado," El Cuyo del Chicosapote, near Frontera, Tabasco, June 18, 1897 (Townsend). Div. Ent., No. 7611.

Lecanium tuberculatum, sp. nov.

♀. Scale very convex, rounded-oval, sometimes nearly round, normally about 4 mm. in length, 3 mm. in width, and 2 mm. in height. Color clear reddish-brown, the margin narrowly dark brown. Scale finely tuberculate and pitted near border, coarsely and less conspicuously tuberculate on rest of surface, the low rounded tubercles with shallow pits or furrows between them. In shrivelled scales the fine tuberculation is more extentive and conspicuous. Most specimens also show a pair of longitudinal dorsal impressed lines, with one or two less distinct lines running across them at right angles. No glassy secretion apparent on surface of scale. The blackish rim and tuberculatė character of the scale will serve to distinguish it from *perconvexum*, which is uniformly blackish and with only the row of fine tubercles near rim.

Legs very short, tibia and tarsus equal in length and about as long as broad; the tarsus hardly narrower than tibia, rounded apically and not pointed; claw short, stout, strongly hooked, and about half the length of tarsus; femur but little longer than tibia, wider basally than apically, and as long as apical width. Digitules of tarsus and claw stout, filiform, the claw digitule apparently longer than the tarsal, which latter is about as long as the claw itself. Anal plates subtriangular, together forming nearly a square, but somewhat rounded on the caudo-lateral margin. Anal ring with four bristly hairs showing between the opened plates. Dermis chitinous, with gland pits moderately small and rather numerous. Boiling in KHO stains liquid pale brown.

Belongs to the neotropical group of *perconvexum*, *chilaspidis*, *urichi*,

imbricatum, etc., characterized by the short rudimentary legs. It comes nearest to the Brazilian *perconvexum* Ckll.

On twigs of tree called "cafetillo," San Antonio del Sapotal, near Frontera, Tabasco, June 2, 1897 (Townsend). Div. Ent., No. 7809.

Aspidiotus jatrophæ, sp. nov.

Belongs in the subgenus *Diaspidiotus*. ♀ scale circular to suboval, convex, pale grayish-brown, 1½ mm. in diameter. Exuviæ nipple-like, situated usually to one side of the middle, concolorous with rest of scale but of a darker shade. ♂ scale suboval or oblong, same color or a little paler than ♀, 1 mm. long and about or little more than half as wide. Scales not leaving a white surface on the bark when detached.

♀. Circumgenital glands absent. Anal orifice near posterior extremity. Three pairs of lobes. Median lobes large, oblique, very strongly notched on outer side, not at all on inner side. Well marked glandular incisions in the interlobular intervals. Chitinous processes of the glandular incisions resemble those of *A. betulæ*. First interlobular interval moderately wide. Second and third lobes minute, dentiform. Spines unusually large and stout. Outer spine-like plates much branched, those of first interlobular space simple and two in number. Body of ♀ broad pyriform, yellowish brown. Species doubtless viviparous, as the ♀ is filled with large well developed embryos, and lacks the circumgenital glands.

♂ and ♀ scales massed together on bark of main stems and branches of *Jatropha* sp., called "chaya," a cultivated plant whose green juicy stems are cooked for food. Frontera, Tabasco, May, 1897 (Townsend). Div. Ent., No. 7682. This is a southern species of a northern type.

Aspidiotus agavis, sp. nov.

Belongs in subgenus *Chrysomphalus*. ♀ scale circular or subcircular, brownish-gray, the marginal portion whitish. Exuviæ central, black or blackish, more or less covered with a gray secretion which is usually scaled off and shows only as a border to the exuviæ. Diameter, 1 to 1½ mm.

♀. Body deep yellow. Three pairs of lobes. Median lobes widened, appearing like human incisions, contiguous to each other. Second pair of lobes about one-fifth wider than median, third pair same as second. Distance between median and second pairs of lobes less than half width of one of the median lobes. Distance between second and third pairs nearly equal to width of one of the median lobes. Spine-like plates moderately short. There is a rudimentary angular fourth lobe beyond the third pair, and the margin of the body beyond the lobes is serrate for a distance equal to that occupied by the lobes of one side, the serration being composed of smaller spine-like plates. Beyond this the margin of the body is minutely serrate. Four groups of circumgenital glands, cephalolaterals 16 in each group in one specimen; in another 13 to 16, more or less prolonged inwardly in group outline instead of rounded as normally. Caudolaterals apparently with 8 glands each.

This species is allied to *A. nigropunctatus* Ckll. It resembles it in general appearance by the blackish exuviæ, and the lobes are similar in form. It may be distinguished from that species by the lobes being entire, not notched. The scales are also uniformly smaller than in *nigropunctatus*.

Massed on leaves of *Agave* sp. Toluca, Mexico, August 29, 1897 (Koebele 1697). Div. Ent., No. 7935.

Aspidiotus koebelei, sp. nov.

Belongs in the subgenus *Chrysomphalus*. Allied to *A. albopictus* Ckll., from which it differs as follows: Caudal end not so narrow and pointed. Caudolateral glands 3, cephalolaterals 4. Tubular glands short, only about as long as the median lobes, eight in number, the median pair having their origin posterad of the rest. In immature females these glands are much longer, and much resemble those of *albopictus*. Median lobes well separated, about as wide as long, rounded, entire. Second pair of lobes removed from the median a distance equal to diameter of either lobe, about same width as median, entire. Third pair pointed, tooth-like, somewhat farther removed from second than are latter from median, less conspicuous than other lobes. Farther down the margin a rudiment of a fourth lobe appears. Anal orifice (apparently) close up near base of tubular glands.

♀. Scale circular to suboval, flat or but little raised, 1½ to 2 mm. in diameter, usually clear light brown but sometimes more or less grayish. Exuviæ a little to one side of center, marked only by a darker ring in some specimens, in others nearly concolorous with rest of scale, while in still others they are grayish or of a lighter color. ♂ scales oblong or long-oval, usually pale grayish-brown, the exuviæ usually nearer one end and light reddish-brown in color.

Numerous ♂ and ♀ scales massed on leaves of orange, Oaxaca, Oaxaca State, August 22, 1897 (Koebele 1656). Div. Ent., No. 7935.

Aspidiotus albopictus var. **leonis**, var. nov.

The characters of the ♀ are the same as in *albopictus*, except that the caudolateral glands number 5 to 6, and the cephalolaterals only 6 to 7. *A. albopictus* belongs in *Chrysomphalus*. One specimen is infested by an interesting fungus.

♀. Scale circular, flat, averaging 1½ mm. in diameter. Color of scale flesh-gray, outer border more or less distinctly whitish, the whitish often invading most of surface. Exuviæ often nearly central, pale brown Although the characters of the ♀ insect are nearly the same as in typical *albopictus*, the present specimens represent at least a good variety in the considerable differences in the characters of the ♀ scale.

On leaves of orange, Linares, Neuvo Leon, Dec. 17, 1897 (Townsend). Div. Ent., No. 7935.

Diaspis baccharidis, sp. nov.

♀. Scale rather broad oyster-shell shaped, 2 to 2½ mm. long, 1½ to 2 mm. wide, flattened, exuviæ at smaller end which corresponds to the hinge end of an oyster shell, leaving a whitish film on bark when detached. The inside or underside

of the scale is grayish in color; the outside surface is wholly covered in all cases, with a fungus of a grayish-brown color, obscuring the color of the scale so that it is impossible to distinguish it.

♂. Scale is quite distinctly tricarinate, 1⅓ to 1½ mm. long, ⅜ mm. wide white; exuvium at one end, brownish-yellow or yellowish-brown. The ♂ scale is different in texture from that of the ♀.

♀. After boiling, subcircular, tinged with brownish-yellow at least anally. Three pairs of lobes, the median largest, almost imperceptibly excavated on their outer posterior border, very slightly notched on inner posterior border, about as wide as long, slightly separated, not contiguous. Second pair of lobes subround, rather less than one-half the width and length of median lobes, each removed by about its own width from median lobes, entire. Third pair of lobes small, about half the size of the second pair, appearing as tubercles on the margin, removed from second pair a distance equal to rather more than twice their diameter. Small sac-like structures situated at bases of lobes resembling in form those of *Diaspidiotus*, those of each median lobe appearing nearly U-shaped, being very indistinctly separated at base; those of third lobes shaped like a pair of heavy dots, those of second lobes transitional in form between those of median and third lobes. There are also still a fourth pair, and even a rudimentary fifth. Spines rather small and short. Spine-like plates not large, not long, equalling in length the median lobes. Anal orifice about five times its diameter removed from anal end of body, well posterior to the level of the caudolateral glands. Five groups of ventral glands, in form mulberry-shaped, especially the cephalolateral pair. Caudolaterals, about 20; cephalolaterals, about 30 or more; median group, 15.

On bark of woody stalks of *Baccharis glutinosa*, Amecameca, Mexico, June 1, 1897 (Koebele 1758). Div. Ent., No. 7959.

Pseudoparlatoria serrulata, sp. nov.

Distinguished at once from the other species of the genus so far known by the minutely serrulate character of the lobes. Five groups of circumgenital glands caudolaterals 11 to 15, cephalolaterals 12 to 15, median 2. Allied to *P. noacki* Ckll., rather than to *P. parlatorioides* Comst., as indicated by the five groups of glands, the latter species having only four. The median lobes are not so pointed as in *noacki*, but are rather rounded; while not notched like *parlatorioides* (as in Comstock's figure), they are rather inconspicuously notched nearer the base. The spine-like plates of first and second interlobular spaces are shorter than in either species, projecting but little beyond the end of the lobes. Lobes of second pair divided into three lobules. Fish tail structure between the median lobes hardly projecting beyond the lobes.

♀. Scale 1½ to 2 mm. in diameter, flattened, subcircular, whitish, grayish, or greenish gray; exuviæ lateral, pale yellowish or yellowish-brown. ♂ scale small, subpyriform, about 1 mm. long, exuviæ at the wider end; color grayish, with exuviæ yellowish.

On leaves of unknown tree Hernosillo, Sonora, April 23, 1897 (Koebele 1719). Div. Ent., No. 7934.

SOME MEXICAN PHALANGIDA.

BY NATHAN BANKS.

Cynorta mexicana, sp. nov.

Length body, 6.5 mm.; breadth, 4.5 mm.; femur I, 2 mm.; femur II, 3.5 mm. Dull yellow brown, tibiæ darker, last palpal joint black. Dorsum nearly smooth, eye tubercle low, smooth; tibia of palpus very broad, last joint ending in a fine curved claw; legs I, II and III nearly smooth, with fine hairs; venter smooth; dorsum of abdomen with low tubercles along each side to the hind femora, on hind part of middle a pair of very small tubercles, scarcely evident, and behind them a transverse row of four minute tubercles, the hind border of the shield and of the next two segments with a row of small tubercles; hind leg spinulate on femur, patella and tibia, rather more strongly on last two, on inner side of femur near tip is a larger, prominent, blunt spine. Readily known from our forms by larger size, absence of markings, small tubercles, and armature of hind leg.

Erginus mexicana, sp. nov.

Length, 3.9 mm.; femur I, 1.7 mm.; femur II, 3.1 mm. Body almost uniform pale yellowish, legs paler, nearly white. Dorsal surface evenly and rather roughly granulate, eye-tubercle broad, low; basal joint of mandibles swollen above and prominent, distinctly granulate; palpi appressed to mandibles, the femur broad, denticulate above, below on inner margin with six blunt teeth, tibia very broad, concave within, margins with bristles, tarsus slender, one half length of the tibia, ending in a long, fine, curved claw; venter and coxæ granulate; the margins of the very much retracted segments denticulate; legs slender, finely granulate, fourth pair nearly as long as second, but the fourth tarsus shorter than that of second leg.

One specimen; readily known by the blunt teeth under the femur of palpus.

Liobunum mexicanum, sp. nov.

Length body 4 mm., femur I, 11 mm., femur II, 18 mm. Dark brown above, nearly uniform, but faintly showing a chocolate brown vase-mark on basal part of abdomen; beneath wholly pale; palpi pale, brownish on base of the femora, above on patellæ, and at base and tip of the tibiæ; mandibles pale; legs brown, with scattered pale dots on basal joints, often arranged in groups, coxæ pale, trochanters brownish, extreme tip of tibiæ pale. Dorsum above quite finely and regularly granulate; eye-tubercle quite high, smooth, the eyes prominent; last joint of palpus as long as tibia and patella together, scarcely curved, each of the coxæ I, II and III terminate above next to the body in a small white spine.

Amecameca [Barrett]. The specimen has but three legs on the right side, leg II being absent and its coxa is rudimentary.

Liobunum albipalpe, sp. nov.

Length body 5 mm., femur I, 12 mm., femur II, 20 mm. Palpi white, basal joints rather yellowish, mandibles pale yellowish; cephalothorax black in center,

whitish on front and sides, and narrowly behind; abdomen black, a whitish stripe on the side of basal half and two or three of the segments behind are narrowly white on the side of the apical margin; coxæ and venter almost black, four elongate whitish spots just behind hind coxæ, the basal one much the largest; trochanters black, legs brown, pale on middle of femora, darker on patellæ. Eye-tubercle moderately prominent, faintly roughened above; patella of palpus with a distinct projection at inner end about as long as width of joint, tibia scarcely longer than patella, last joint slightly curved, fully as long as tibia plus patella; basal part of abdomen finely rugulose, also the apical portion of the apical segments; legs faintly roughened.

Readily distinguished by the white front and white spots behind coxæ.

Leptobunus spinulatus, sp. nov.

Length 11 mm., femur I, 5 mm., femur II, 9 mm. Black, mandibles pale yellowish, patella, tibia, and basal half of tarsus, of palpus yellow brown, coxæ dark yellow brown, extreme base of femora whitish, tarsi brownish. Eye-tubercle low, with a few spinules above, a group of numerous spinules on front border, all small; palpi with short stiff hair, tibia much longer than patella, tarsus longer than both together, nearly straight; coxæ with granules, and trochanters spinulate, rows of spinules on the femora, more irregular on patella and smaller on tibiæ; tibia II nearly smooth, with two false articulations, none in other tibiæ, none in anterior metatarsi; abdomen with transverse rows of minute, pale, pointed tubercles, rather few in a row.

Related to *L. grande*, but much more spinulate.

LIFE-HISTORY OF FERALIA JOCOSA.

BY OTTO SEIFERT.

This pretty species may be found in the vicinity of New York from the last days of March to the end of April, wherever hemlock trees (*Tsuga Canadensis*) grow in any number. The moths emerge from their pupæ about noon and ascend the hemlock trunks to develop their wings. Sometimes, on very cold days, they remain resting near the ground, as if paralyzed by the severity of the weather. When disturbed, they seem indifferent at first, but later suddenly dart off, usually to the higher branches of the trees. They are easily found, as their bright colors contrast with the dark bark, especially after rain; but they are never abundant and seem to prefer spending their lives high up amongst the foliage of the trees, so much resembling their own colors. I have never been able to find a pair in copulation, though I have often observed males and females on the same trunk. When taken home and

kept carefully with hemlock sprigs in large glass vessels, they remained nearly inactive and finally the females laid unfertilized eggs. It may be mentioned here that these moths can be kept alive for a comparatively long time when fed on slices of fresh apple.

The entire existence of this insect is bound and admirably adapted to the conifer on which it feeds. In April and May the mature hemlocks develop their flowers. The staminate aments are produced profusely on the younger, higher branches. The moth is only to be found on the larger trees. The impregnated female runs restlessly up and down the branchlets until it finds a twig with the budding staminate aments. These latter appear in numerous clusters and here on the adjoining leaves the moth deposits its rather large, pale honey yellow eggs. One or a few are glued to a leaf, mostly on the under side. The whole number of eggs rarely reaches 150.

The eggs hatch after 14 to 16 days. The pale greenish yellow larvæ at once attack the undeveloped anther sacks and feed on these only at this stage. They bury their heads and part of their bodies in the buds, covering themselves over with pollen grains. As soon as the anthers reach maturity, develop their tender filaments and turn light brown the young caterpillars leave them entirely and take to the new leaves which have just opened. In the successive stages they gradually abandon the growing leafy shoots, touching them only occasionally and, after the last molt, feed exclusively on the deep green perennial leaves. They often denude small twigs of their leaves and leave only the light green terminal shoots on the branches.

By the changes of color and design during growth the larvæ follow the successively acquired food habits. Very young larvæ are pale yellowish green, the color of the budding staminate aments; after this they change to bright, light green; then they obtain pale white longitudinal bands; later on they change to bright pea green with intense white stripes from the head to anal segment and a cherry red suprastigmatal line bordering the white stigmatal stripe; at last the bands are broken into oval spots partly tinted and edged with yellow and red. Now the glossy, deep pea green, checkered caterpillar is admirably adapted to the deep green lacquered perennial leaves of the hemlock, variegated with flowers and buds. About six weeks after leaving the egg shell, the larval period is completed and the trim creature descends the tree, probably at night, digging into the ground close to the trunk and near the surface to form an almost oval, soft, but tenacious cocoon of earth and silk. In this it transforms to a brown pupa in a few days.

It might be rash to assume these seemingly adaptive changes of habits and colors in the larval state to be a protective measure. The insect, on account of its early appearance, hardly needs much protection from enemies. Birds are rather scarce at this time, especially in hemlock groves and probably would detect it in any case. Ichneumon flies and other parasitic hymenoptera are almost out of the question. A small Carabid beetle which ascends the trees at night and a rather large green hemipteron lurking often on the bark in day time probably never will infest the lofty habitat of the *Feralia* larvæ. Even the colors of the imago resembling the green and white mottled lichens on the bark are to all appearance of not much protective value, as some mutilated moths found near the trunks had apparently been killed by Carabids while resting on the bark. Probably the larva simply follows the general law of markings (Eimer, Artbildung bei den Schmetterlingen; Orthogenesis, etc.), gradually converting the primitive pattern of longitudinal stripes into spots. In this case these changes apparently coincide with the different surroundings which are conditioned by the altering food habits.

Egg.—Rather large, of the typical noctuid form; semiglobular, much flattened at base, depressed on top; pale honey yellow with faint greenish tint, extremely thin shelled and soft; closely ribbed when magnified, the ribs appear as blunt ridges with many irregular indentations, these ridges widening toward base, do not all commence from the vertex, nor do they all reach the base.

Eggs laid April 7th commenced to hatch April 21st. The young larvæ do not eat their egg shells, but making an opening side ways, they leave the delicate, colorless, transparent membrane in shape.

First stage.—Larvæ slender, almost pellucid, of a pale greenish yellow color. Skin not smooth but irregularly folded. Head rather large, sparsely hairy, mouth-parts and ocelli pale yellowish-brown. On 1st, 2d and 3d segments dorsally shield-like plates indicated, those on 2d and 3d are omitted after moulting. Eleventh segment humped slanting to anus, this hump before first moult has a raised shield-like plate covering the entire dorsal and subdorsal region. Segments, except thoracic and last, with five minute black dots each bearing a short slender hair arranged in the usual noctuid way (Dyar, Classification of Lepidopterous Larvæ); the three first segments have a few more delicate hairs and above cremaster a transverse bow of about 24 minute hairs. The young larvæ have during their earlier stages a looper-like gait and habits, holding with the after legs to a sprig and stretching the body

out like a stick. They are fond of spinning small networks over the leaves especially when moulting and drop on a thread when disturbed, but these customs are gradually abandoned during their moults. Before changing their skins they turn sordid olive green, moult during the night and eat their cast-off skins except the head shell.

After first moult.—The larvæ are bright yellowish green, slightly paler ventrally. Skin very transparent, contracted. Head comparatively smaller than before of very pale tan-color, mouth parts light brown, ocelli darker. First segment somewhat swollen, hump much produced. An indistinct stripe forms dorsally, more distinct from seventh to last segment, also a very pale whitish green lateral stripe.

After second moult.—They change to bright, glossy pea-green with pale bluish white dorsal, lateral and stigmatal stripes, all equidistant. The stripes run from first segments to the last, the stigmatal continued by a narrow line above cremaster. Cervical shield indicated by a slight depression and still brighter green, hump on top also more shiny.

After third moult.—The stripes turn clear, heavy white. The stigmatal one is bordered above by a cherry-red line. The larvæ vary much in deeper or lighter shade of green, from pea-green to bright olive; the red line with different individuals is more or less intense and when most prominent it is edged below with yellow and the stigmatal stripe appears cream-colored.

After fourth moult.—The ground color is still more glassy and transparent pea-green: stripes chalky, finely wrinkled. The dorsal stripe rather even, the lateral one almost uniform on the three first segments, but then widening in the middle of the segments and tapering in the incisures forms a chain of elongated spots. The stigmatal stripe is broken up into eleven irregular, half-moon shaped spots; conjoined. The humped 11th and 12th segments have only one spot, but enlarged; these spots are bordered above with cherry-red and shaded with yellow on the edges and junction. A pedal line of yellowish-white, oblong, irregular spots forms above the abdominal feet and on the tenth segment.

After fifth moult.—The larvæ attain their maturity. Full-grown they are nearly cylindrical, about 32 to 35 mm. long, width 4.5 mm. All 16 feet normally developed. Eleventh segment forming a hump slanting to cremaster. The few short delicate hairs distributed as before, but hardly perceptible. The finely granulated skin folded, especially on stigmatal area. Ground color deep, glossy pea-green, very transparent; head and legs more yellowish green; cervical shield and hump still brighter green. Dorsal and lateral stripes chalky white, finely

wrinkled, running from first segment to last. Dorsal stripe uninterrupted, on thoracic segments nearly uniform, then widening in the middle of segments and narrowing in the joints. The lateral stripe follows the same principal, but in a more complete way, being almost uniform on thoracic segments and forming a chain of spindle-shaped spots on the abdomen connected by a narrow line. The spot on the eleventh segment runs in a line to anal plate. From first to last segment a stigmatal row of eleven large, half-moon shaped, cream colored spots, yellow on the edges and bordered above their full length with cherry red; on the three first segments the spots are more elongated forming almost a band, but they are disconnected; on last two segments one large spot which ends in a narrow white stripe, edged above with yellow, bordering the anal plate. A pedal line of oblong, irregular cream colored spots, one on each segment except on first and twelfth. Spots on second and third segments smaller than the others, the latter extending almost over the whole width of the segment.

The larvæ vary in the deeper or lighter shade of green, the intensity of the red color and prominence of the yellow edgings. One of about 75 full grown caterpillars had all, even the dorsal stripe, converted into oval spots.

From May 30th to June 3d all but a few sickly stragglers had gone into the ground. Some forming their cocoons on the surface, only covered by moss and dry hemlock leaves.

Cocoon.—Rather soft but durable, made of earth and silk.

Pupa.—Rather stout anteriorly, head cases slightly rounded, almost blunt; movable segments tapering much to anal joint, the latter ends in two fine hooks with which the pupa is fastened to the cocoon. Thorax and wing cases brown, the former shagreened, the latter wrinkled, antennæ cases clearly visible, but not much produced. Abdominal segments more reddish brown, finely punctured, the movable ones only so anteriorly. Length of pupa 15 mm., widest in the middle, 5 mm.

The imagines do not vary much in size. Almost all expand 34 mm. (about 50 specimens). There is more variation in ground color and the black scales in median space. The former varies from pea-green to bright olive; also appearing in all shades of cream color. The whole median space is often powdered with black scales, sometimes only partly and in a few specimens the black scales are omitted. The white and black t. a. and t. p. lines are nearly always regular and distinct. The green females seem to be in the majority, but in general the variability in either way is not confined to any sex, nor has the flying

anything to do with it since undeveloped soft winged green females, as well as cream colored ones have been found. Hind wings and vestiture not subject to noticeable variation, nor the underside of primaries and secondaries, which differs only slightly in deeper or lighter shading.

[NOTE.—This larva has occurred to me in the Adirondacks on the balsam fir. Its pattern of markings and coloration are strikingly like those of the pine-feeding Sphingidæ, doubtless in adaptation to the similar environment. H. G. Dyar.]

A NEW DIPTEROUS GENUS BELONGING TO THE THEREVIDÆ.

By D. W. COQUILLETT.

Henicomyia, gen. nov.

Antennæ slightly longer than the thorax, cylindrical, first joint two-thirds as long as the head, the second broader than long, one-fifth as long as the first, third joint of nearly an equal diameter until near the tip, almost twice as thick as the first joint and nearly four times as long, the apical portion tapering gradually to the tip which is truncated and destitute of a style; head nearly twice as broad as long, face bare; proboscis rather slender, the labella of about the same diameter as the proboscis proper, the two together slightly longer than the head; palpi slender, their apices considerably dilated; three ocelli present. Abdomen slender, fully three times as long as the thorax. Wings with two submarginal and five posterior cells, the fourth posterior and anal cells closed and short petiolate. Type, the following species:

Henicomyia hubbardii, sp. nov.

♂. Head black, front somewhat polished, at narrowest part one-third as wide as either eye, antennæ yellow, the second joint and apical portion of the third, brown; proboscis brown, the under side of the basal portion yellow; palpi brown, the apices yellow; a row of black macrochætæ extending around the upper half of the occiput. Thorax and scutellum yellow, polished, a white pruinose vitta in middle of dorsum of thorax, considerably expanded behind the suture, and a white pruinose spot on upper part of the pleura in front of the insertion of each wing; a black macrochæta above, and another in front of, the insertion of each wing, thorax elsewhere, and the scutellum, bare. Abdomen black, polished, the extreme base yellowish, the posterior margins of the first four segments white; hypopygium nearly twice as long as the seventh, or last, abdominal segment. Wings hyaline, a brown cloud on veins at apex of second basal cell, and a brown fascia extending from the costa, a short distance before the apex of the second vein, to the base of the third posterior cell. Coxæ yellow, the posterior ones largely brown and covered with a silvery-white pruinosity;

femora yellow, the posterior ones except the extreme base and apex, brown; tibiæ yellow, the hind ones brown; tarsi brown, the first joint and basal half of the second joint of the hind ones, yellow; all femora and the front tibiæ bare, middle and hind tibiæ thinly beset with very short bristles; pulvilli rather large, empodium wanting. Halteres brownish, the apical portion of the knobs white. Length, 8 mm.

Ft. Grant, Arizona. A single specimen collected July 19, 1897, by Mr. H. G. Hubbard, after whom this interesting species is named. Type No. 4071, U. S. Nat. Museum.

LIFE-HISTORY OF THE TWO FORMS OF CERURA NIVEA.

BY RICHARD E. KUNZE, M.D.

In Professor Packard's Monograph on Bombycine Moths, this Cerurin Moth is mentioned as a varietal form of *C. cinerea*. Under date of August 14, 1897, the doctor wrote me, that "there were two pale or white forms of *cinerea* in my region, whose larvæ need to be identified." Professor Packard in his monograph states, that the white color of an example of *C. nivea*, in Mr. Palm's collection, from the Virgin river, southern Utah, is evidently the result of the action of bright sunlight, heat and dryness. The same conditions exist in the Salt River Valley. Phœnix and Yuma hold the record for highest temperature of Arizona, that of the former being 117° Fahrenheit in the shade, while that of Yuma exceeded it by two or three degrees. This information I obtained from U. S. Weather Bureau of this City, and an attaché of the same formerly stationed in Yuma. My examples of *nivea* were all collected at light in Phœnix up to the end of June, a few emerged from collected cocoons, and of those sent six to Mr. Charles Palm for determination. The reply stated, that according to the synopsis of Neumoegen and Dyar, they were *Cerura nivea*, variety of *cinerea*. Since my correspondence with Professor Packard, have taken the autumn brood of this insect, from which I bred from ova to pupæ and imagines, and will now give as a result, that this moth has an undisputed right to rank as a species, and not as varietal form of *cinerea*. In its earliest larval stages the resemblance is nearer that of *cinerea* than any other Cerurine, while the last two stages more nearly resemble larvæ of *C. multiscripta*. In the East have bred from ova and collected larvæ of any number of *C. cinerea*, *multiscripta* and *borealis* and well remember the larval life of those species.

As before mentioned, there are two annual broods in this hot and arid region. The larva feeds on willow and cottonwood and I have collected cocoons early in spring from both food-plants. The examples which served for observation, were two females taken in September, 1897, in Phœnix. One of these was almost immaculate, except a small black spot between the veins of external border of primaries. The other was marked at the base and near cell of primaries with a few black patches and irregular markings. Bodies of both heavily clothed by long white hair, and at first thought I had taken a *Spilosoma*. The base of wings likewise thickly covered by a thick mass of shorter hair than on the body. The males of this species have longer hair than the females. These Arizona cerurines are much larger than the *C. cinerea* of the East. After ovipositing I sent both females, a little the worse for functions performed, to Professor Packard, and also better examples of the spring and autumn broods of both sexes. Ground color of all was snow-white.

The first female secured I placed in a paper box for ovipositing. This example regarding ornamentation, agreed more fully with figure 19 of Packard's Bombycine Moths, described as *C. cinerea* var. *nivea* or Dyar's type of *meridionalis*, ♂. On the night of Sept. 19th a few eggs were laid and some more the following evening. They were laid singly and in piles of 5 to 6 each. They were black, of a dull color, hemispherical and flat at base. Size 1.5 mm. Seven larvæ hatched Sept. 26th and eight more Sept. 27th, between the hours of 8.30 and 9.45 A. M., making time of hatching seven days.

Stage I.—Face neutral pink, pilose, the same as the rest of the body. On all the joints white hairs. Joint 2 has two lateral prothoracic horns finely spinose, of purple color. These processes connected by a dorsal ridge. Two subdorsal, purple stripes from joint 2 to 7, interrupted on joints 8 and 9, and continued from joint 10 to 12. Joint 13 has appended two anal, filamental legs or "tails." Dorsum greenish-yellow in a continuous line to penultimate joint. Dorsum of segments 7, 8 and 9, presents a diamond-shaped mark, due to absence of subdorsal purple stripes. Tails covered with spines or spinules, annulated purple and greenish-yellow. Near insertion the "tails" are purple, and of similar color at middle and terminal parts. Feet yellowish white, almost concolorous with body. Length of larva without stemapods, 3 mm. and inclusive of these organs, 5.5 mm. The head .5 mm. in breadth, space between head and middle of body .33 mm. breadth, and between joints 6 and 7, .5 mm.

Stage II.—Observed October 3d, larva seven days old. Length of larva without stemapods, 14 mm and inclusive of "tails," 19 mm. Width of joint 2, 2 mm., and of joints 6 and 7, 1.25 mm. Length of prothoracic horns, 1 mm., width of ridge connecting these processes, 3 mm. Face and body sparingly covered with white hair. Face and vertex speckled brown and green. Middle of face and mouth parts green.

Laterally a green stripe passing from vertex to mouth. Prothoracic horns brown, covered with greenish tubercles supporting a black spine. A greenish-yellow dorsal stripe, becoming triangular on joints 2 and 3; it becomes narrow and again widens on joints 6, 7, 8 and 9 into a diamond-shaped patch, constricted on joint 11, and finally widening on joints 12 and 13. A triangular brown patch in the middle of joint 3. A brown spot on joint 6. Joints 7 and 8 ornamented by an oval brownish spot centered green, and surrounded by a circle of minute, greenish tubercles. From the middle of joints 9 to 11, a brownish patch like a maple leaf. Across the penultimate joint a longitudinal brownish dash. Lateral parts of larva green, of the same color as leaf of cottonwood. All legs concolorous with lateral parts. Feet whitish. The green of abdominal parts a lighter tint, and last two joints almost white. Stemapods of a color approaching a purple or lilac brown, annulated with greenish-yellow. The extensile part of outer third of "tails" of darker shade. Spinose from insertion to tip.

Stage III.—Noted October 11th, larva 15 days old. Length of larva at rest 24 mm., of body from head to venter, 18 mm. and of stemapods, 8 mm. The width of joint 2, 3.5 mm. of joints 6 and 7, 3 mm. Head subquadrate, 3 mm. in length and 2.5 in breadth. Head brown, face almost oval, brown and of lighter tint at mouth parts. Ground color of face a much lighter brown covered with dark spots. Lateral parts of face tinted brown. Vertex light brown, the same color passing over dorsum joints 1 and 2. A chocolate brown triangular patch on joint 5, widening on segments 6 and 7, and narrowing on joint 8, forming the first, anterior diamond-shaped ornamentation. The same brown dorsal patch is repeated on joints 11 and 12, not quite so large. On joint 13 there is more of an elliptical brown dorsal patch, reaching to venter. A yellow border a little broader than the width of stemapod, passes like an irregular subdorsal line below the brown ornamentation. This line starts at the head and continues uninterruptedly to venter. On joints 3 and 4, this yellow line almost meets with only a trace of brown between. Lateral parts of larva green, exact counterpart of cottonwood leaf, covered by yellowish-white and lilac purple papillæ, some surmounted by hairs. A few dark brown papillæ on dorsal patches. Thoracic and abdominal legs green like lateral parts. Feet of a lighter tint. Stemapods lilac brown near venter, of lighter tint at the "flagellum," and twice annulated yellow, and spinose covered with setæ. Venter and abdominal parts of last three segments whitish. All other abdominal parts of larva conclorous with lateral surface. The spiracles light brown, edged by a tint of green and white centered. Feet quite pilose, hairs fewer in number toward spiracular line.

Stage IV.—Not observed until nearly mature. October 22d, mature larva 26 days old. Length at rest from head to venter, 30 mm., while in motion 37 mm., of stemapods 9 mm. when undisturbed, and during flagellation 10 mm. This gives entire length of 39 mm. at rest.

Length of head 3 mm. and over, width 3 mm. Width of segment 2, 5 mm., of joint 7, 6 mm., of joint 10, 5 mm. Dorsal abdominal diameter of segment 7, 7 mm. Head subquadrate or nearly so, a triangular patch on vertex. Color of head lilac brown with a brown spot each side of vertex. Face of lighter tint, lateral parts yellowish. Antennæ also yellowish. Mouth parts blackish. Dorsal ornamentation of a triangular patch, whitish within and lilac edged, on segments 2 and 3. The median dorsal surface is almost milk white, much as in *C. multiscripta*, thus widely separating

larval differences of *nivea* and *cinerea*. The dorsal ornamentation of larva of *nivea* is bordered by a faint yellow line. Dorsal patch of joints 6, 7, 8 and 9, diamond-shaped, bluish-white on median line, edged rosy lilac when viewed in certain light and bordered yellowish. All diamond shaped patches much constricted near place of union. The patch of segments 10 and 11, also diamond shaped and in coloration like preceding. On segments 4 and 5, the yellowish border of dorsal patch is almost confluent, a trace of lilac tint between it. Joint 12, has a median lilac line which widens on joint 13, to form a smaller diamond patch reaching to venter. This dorsal patch is more lilac on median surface than the other. A brown elevated spot now marks the place of former prothoracic processes. Supra and infraspiracular surface light green, spotted and speckled lilac and yellowish over entire parts, as far down as feet. These spots vary from ovoid to hemispherical. Below the yellowish border of dorsal ornamentation of posterior half of body, the green color of larva is lighter tinted, spiracles brown, white-centered. Thoracic feet yellow, laterally spotted brown and sparingly pilose. Abdominal feet pilose, clasping surface white, and just above a brown lunulate mark covered by 6–8 hairs. Abdominal surface concoloring with lateral parts. Dorsal and lateral surface smooth. Stemapods have lost the bright color of previous stage. Spinose, with setæ now very short.

Cocoon.—Color, dark drab. Shape, elliptical, very little flattened, strong, not indented by finger. Size, length, 24 mm ; width across central area, 9 mm.

On the night of October 22d, this larva only 26 days old, commenced to make its cocoon. The only one other example of this brood for five or six days tried hard to transform and failed, so that finally I made an alcoholic specimen of it for Professor Packard.

WHITE FORM OF CERURA NIVEA.

The accumulated evidence referred to under this heading should be accredited to the whitest form of an Arizona cerurine, heretofore known as a variety of *cinerea*. The example from which bred, a female as white as the driven snow, was ornamented with a minute, black spot between each vein on external margin of primaries. The antennæ showed very little black, which was confined to the branches, all elsewhere a spotless white. The insect was secured at light in this city. Confined in a small paper box, I obtained 65 ova, all laid singly, of which about fifty hatched October 8, 1897. In color and size, as well as shape, the ova were black and hemispherical like those of the previous female referred to. Of this brood about 33 reached maturity, and besides reserved two examples of every stage in alcohol for the use of Professor Packard. A full-grown larva or nearly so, by the time it arrived in Providence, R. I., was sent alive, and of which the doctor wrote me, Mr. Joutel made a beautiful figure. Of the earlier stages I

did not take notes, inasmuch as they resembled the progeny of the other cerurine referred to above.

Stage III.—Larva molted October 30th, when 22 days old. Length at rest from head to fork of tails, 14 mm. Stemapods, 8 mm. Breadth of joint 2, 5 mm. joint 7, 4 mm., joint 12, 3 mm. Width of head, 3 mm., length 3.5 mm Vertex marked by a triangular green yoke, the point of which passes into the median line or dorsal band. Prothoracic horns now quite rudimentary. A round brown spot quite prominent each side of head, 1 mm. in diameter. A few white hairs on face. Mandibles greenish-white and tinted lilac. In centre of face a brown dot, surrounded by an oval, light brown border above mandibles. On each side of this oval two longitudinal lines of same color and length. Above the brown dot a triangular depression lilac edged, which has passing through the middle a whitish longitudinal bar.

On the anterior part of segments 6, 7 and 9, is a small, whitish triangular spot each side of median line, enclosing a purple oval which posteriorly is surrounded by three or four whitish dots. Joint 10, marked by faint dots of same color. Anterior ridge connecting rudiments of former prothoracic horns, of much lighter color than the rest of joint 2. Joint 4 has an elliptical purple patch, and joint 5, one of ovoid pattern on its dorsal surface. The purple of entire dorsal ornamentation bordered by a bright yellow line, which on anterior half of all segments is half a millimeter in width. This yellow line starts from below the insertion of former prothoracic processes, and is lost at the insertion of stemapods. Lateral surface green, dotted and mottled, with yellowish-white and purple spots. A few hairs on lateral surface. Spiracles tinted brown. Thoracic and abdominal legs a brighter green than the lateral parts of larva. Lateral surface of thoracic feet splashed reddish. Clasping surface whitish. Stemapods anteriorly tinted green, and annulated yellow from the middle to the flagellum. Lateral surface green covered by minute, purple papillæ.

Mature Larva, 35 days old, observed November 12, 1897. Length at rest including stemapods, 40 mm., when in motion 50 mm. Length from head to fork of tails, 32 mm., stemapods, 8 mm. Length of head, 3.5 mm., width, 3 mm. Width of joint, 3. 6 mm, of joint 7, 7 mm, joint 11, 6 mm. Head purple, vertex green, antennæ white. A yellow spot indicates location of former prothoracic horns. The border of entire dorsal ornamentation is now milk-white from joint 2 to 13. The color of dorsum between this border is greenish white in some places and milk white in others.

The color intermediate between the whitered dorsal surface and whitish border line, has now changed to a lilac tint. Lateral surface of larva spotted and marked purple. Thoracic feet whitish, splashed purplish. Abdominal feet whitish and above claspers purplish. On the abdominal surface of segments, between joint 11 to venter, runs a longitudinal, median purple line. A few white hairs below spiracular line. Spiracles brown with a longitudinal, yellowish dash, ringed greenish-yellow. Anterior part of stemapods concolorous with body, and posterior part of these anal filamental organs is yellow. Entire surface of stemapods studded purple. When prolonged the extensive part of outer third of "tails," bright purple annulated lavender. Under a strong lens the purple spinules covering the stemapods, were seen to support a hair.

Cocoon.—In all thirty-eight cocoons were observed. Of these 37 be-

longed to one brood and 1 to another, all but two larvæ of the last died, affected by a fungus which previously existed in the breeding cage. As soon as larvæ commenced cocooning and had the cells well walled the branches were removed into an envelope box, where the transformation could go on undisturbedly, and permit cocoon to harden. The larvæ gnawed off bits of epidermis from the cotton wood, and mixed with saliva, formed when hardened the silken frame for the wall of its cell. It would continue building on the inside of cocoon until of sufficient strength. On the external surface the cocoon resembled the light gray bark of cottonwood, sometimes of very light tint and again of darker color to agree with surrounding conditions. The dark color of cocoon often corresponded with that of the bark deprived of epidermis. Some were darkest at the terminal ends, of a chestnut tint, especially if spun against the surface of the branch covered by an eschar, always of darker shade. Some cocoons on surface exhibited striæ, such as seen on young branches, here and there speckled, or raised bits of bark to mimicry and deceive enemies. In the open I have observed such cocoons on small canes of willow, as well as on the roughest bark of great cottonwoods, from which they had to be chiseled out with difficulty. All such yielded similar imagines as those bred. The inside of cocoon presented a smooth surface, and a concavity existed in the stem where bark was bitten off to receive one-half or one-third of the pupa. The sides of cocoon generally flattened, plainly showing silken threads, where attached to bark.

The cocoon is elliptical, mostly rounded, a very few flattened, tapering at end like a wedge. One or two cocoons seemed to be more ovoid than elliptical in shape. The measurement of another cocoon taken from a second observation jar is as follows: Length, 33 mm., width, 11 mm.; and height at central area, 6.5 mm. Another smaller cocoon gave length, 25 mm.; width, 9.5 mm.; and height, 5.5 mm.

All larvæ of this brood spun their cocoons between November 8th and 17th.

Pupa.—Cylindrical, tapering mostly at inferior extremity, where much rounded. Toward the head much less reduced in size. The flattened parts of pupa restricted to upper two-fifths, and on abdominal surface extending almost to the end of wing cases. Head and antennæ case prominent, and that of wings much more on dorsal surface. Abdominal segments on dorsal surface thickly covered with fine, dark points, as viewed through a lens. Length, 21 mm., breadth, 7 mm at the middle part, and 6.5 mm. across thorax. Color of dorsum almost chestnut of lighter tint toward anal segment. A longitudinal, dorsal black line from the thorax to penultimate, abdominal joint. Color of case covering palpi, antennæ and wings, show

traces of a greenish tint as far down as costa of primaries. Abdominal segments a shiny, light brown almost chestnut. Posterior edge of three anterior segments heavily banded by darker brown, which is absent on the last two. A slight depression of the case on either side of thorax, between the wings and first adominal segment.

Of twenty-four imagines emerged, I have the following record: April 14, 1898, one ♂ emerged from only cocoon of the first brood the parent representing the ordinary form of *C. nivea.* The emerged moth agreeing quite in every particular with this form. On same date emerged three ♂ of the second brood, bred from an almost immediate female. The progeny all took after the ordinary form of *nivea* as well as twenty others, which emerged in the following order: April 15th, 2 ♀; April 18th, 2 ♂ and 1 ♀; April 20th, 1 ♀ and 1 ♂; April 21st, 1 ♀; April 22d, 2 ♀ and 1 ♂; April 23d, 2 ♂; April 24th, 2 ♀; April 25th, 3 ♂; April 26th, 1 ♀; May 1st, 1 ♂.

Six cocoons of the second brood I sent to Prof. Packard, and have not heard of result. Several went over to emerge in autumn, provided these do not perish.

Imago.—The pectination of antennæ of the male, black. Entire body heavily clothed with long white hair. Head white, across the occiput a few black hairs; on the dorsal part of thorax a transverse mark of black hairs, usually fringed posteriorly with yellow hairs. Abdomen white, forewings white, with a few yellow hairs near base of wing. A triangular, black mark across the middle of the cell. A row of black spots between the veins of external border. A similar row of black spots, across the wing near the end of cell. A few minute black spots near base of wing, between cell and inferior border. A few triangular black spots on costa. Hindwings immaculate. Reverse side of wings immaculate. Antennæ of female simple, black. In other respects, the head, thorax, abdomen and wings are ornamented the same as in the male. Legs white, feet blackish in both sexes. Sometimes the intravenular spots are reproduced on reverse side of wings, and a black spot is noticeable in the cell of inferiors. In the whitest form of _nivea_, black spots occur only between the veins of the forewings close to the fringe of the external border.

Food-plants.—Populus balsamifera, var. *candicans*, one of the Western Cottonwoods, and *Salix* spec., a narrow-leaved willow. One larva near Flagstaff, found on *Populus tremuloides*, much resembling species herein described.

Habits.—The young larva feeds on the tender parenchyma of upper side of leaf, thus exposing the skeleton of the blade. It spins a web, to which it clings. When five days old the larva feeds on the green pulp as well as fibrous part of the leaf, except midrib. It was supposed by some that the anal filamental organs or "tails," were for the purpose of aiding in casting aside dung pellets. This is not the case As stated in a preceding paragraph, I noticed larva less than

three hours old, remove a pellet wedged in tightly between the fork of stemapods, and toss it far away with its mouth parts. In so doing it moved the extensile part of "tails" vigorously up and down. Whenever a larva large or small had to be removed from breeding cage for purposes of noting changes, the stemapods always moved to and fro in a very lively manner. It appears that it might be to frighten enemies. Whenever a larva, while in process of making cocoon, was disturbed, especially before completely housed in it, would endeavor to spin it elsewhere. Even the change from perpendicular of breeding jar to that of horizontal final depository, would cause it to make the attempt. One larva left its cocoon and transformed into pupa in an envelope box.

General Observation.—The first molt of larva occurred in from 7 to 7½ days. Second molt in 15 days. Third molt in 21 days and over. Warm temperature, and moisture seems to facilitate some of the stages. Cool weather much retards the time between stage IV, and pupating. One larva commenced to make its cocoon when only twenty-six days old, and others when from four to five weeks old. After ceasing to feed, the larva rests a day or longer and contracts in size before the last transformation takes place. A week after second molt the color of the dorsal band or diamond patches, changes from chocolate brown to lilac brown, which in certain lights varies from amethystine to purplish tints. Two annual broods occur in Arizona, the pupa of autumn brood hibernating.

PRELIMINARY LIST OF THE DRAGONFLIES OF STATEN ISLAND, WITH NOTES AND DATES OF CAPTURE.

BY WM. T. DAVIS.

There are no large, clear ponds on Staten Island like Echo Lake and Green Pond in northern New Jersey, and consequently the dragonflies that make such bodies of water their home, are not to be found on the Island. The sub-family Libellulinæ, however, seems to be well represented and all but two of the species mentioned by Mr. Philip P. Calvert in his Catalogue of the Dragonflies of the Vicinity of Philadelphia, page 267, are here recorded.

Thanks are due to Mr. Calvert for identifying species, or passing upon identifications already made, and at his suggestion I have indicated, by placing an asterisk before their names, the seven dragonflies which are additions to the list of "The Odonata of New York

State," published in this JOURNAL, Vol. III, pp. 39–48 and Vol. V, pp. 91–95.

Subfamily CALOPTERYGINÆ.

Calopteryx maculata *Beauv.* Common along the banks of brooks in July and August.

Subfamily AGRIONINÆ.

Lestes congener *Hagen.* September.

Lestes unguiculata *Hagen.* On July 15, 1894, several females were ovipositing in the stems of grasses growing on the edge of one of the Four Corners iron mine ponds.

Lestes forcipata *Rambur.* May, June, August.

Lestes rectangularis *Say.* June, July, August.

***Lestes inequalis** *Walsh.* July.

Argia violacea *Hagen.* July, August.

***Argia apicalis** *Say.*

***Nehalennia posita** *Hagen.* June, July, August.

Amphiagrion saucium *Burmeister.* June, August.

Enallagma civile *Hagen.* June, August, September.

Enallagma aspersum *Hagen.* June, July, August.

Enallagma signatum *Hagen.* June, August.

Ischnura verticalis *Say.* May, June, July, August.

Ischnura ramburii *Selys.* September, October.

Anomalagrion hastatum *Say.* July, September.

Subfamily GOMPHINÆ.

Gomphus exilis *Selys.* May, June, July.

Gomphus villosipes *Selys.* June.

***Cordulegaster maculatus** *Selys.* Richmond. May 30, 1890.

Subfamily ÆSCHNINÆ.

Epiæschna heros *Fabricius.* May, June, July, August. On the 7th of June, 1885, at 8.35 P. M., one of these insects flew into my open window. There was a light in the room at the time. The female has been observed on the 28th of July laying eggs in dead, water-soaked branches lying in swampy pools in the woods.

Boyeria vinosa *Say.* July (September. N. J.)

Basiæschna janata *Say.* One male. May 2d.

Æschna juncea *L.* var. **verticalis** *Hagen.* June, September, October. On the 21st of October, 1882, in the Clove Valley, one of

these dragon flies was seen to crawl down a stick lying in the water until it was entirely below the surface of the pool, as recorded in Entomologica Americana, Vol. I, p. 18.

Æschna constricta *Say*. June, September, October. On August 26, 1894, about six P. M., several hundred dragon flies were seen flying westward over Slosson's Lane, West New Brighton. They were a species of *Æschna* as I could see with my glass, but none flew low enough to permit of capture.

Anax junius *Drury*. April 9, 1893, plentiful at Watchogue. May, June, July, August and September. In copula May 5.

* **Anax longipes** *Hagen*. Clove Valley, June 5, 1881; August, 9, 1885. Also at Orange, N. J.

Subfamily CORDULINÆ.

Tetragoneuria cynosura *Say*. May, June, July.

Subfamily LIBELLULINÆ.

* **Pantala flavescens** *Fabricius*. July, August, September. July 30, 1887, at New Brighton. On July 31, 1887, there were many specimens near the reservoir of the Crystal Water Company at Four Corners, nearly all of them keeping over a field of oats. They were quite difficult to capture, except those newly emerged from the pupæ, and all that were seen closely were males.

Tramea carolina *Linné*. May, June, July, August, September On July 15, 1894, a male *Tramea carolina* was flying over one of the Four Corners iron mine ponds. Soon a female came and commenced dipping her abdomen into the water. In a moment she was seized by the male and they flew away. In a half hour they were back and went flying about together, the male now and then suddenly letting go his hold and with equal rapidity catching the female again by the neck. Other male dragonflies flew after them and when the female stopped to lay eggs, they annoyed her considerably. The chief among the disturbers was a *Libellula basalis*. After a time the male *Tramea* left his mate and she was quickly seized by the aforesaid *Libellula basalis*, after which they flew about together for a considerable time. After letting go his hold once and flying down the pond, the *L. basalis* returned and seized the *Tramea* a second time.

Tramea lacerata *Hagen*. May, June, July, August, September. Often quite abundant on the salt meadows.

Libellula basalis *Say*. June, July.

Libellula auripennis *Burmeister*. May, June, July.

Libellula cyanea *Fabricius*. June, July, August.

Libellula exilIena *Westwood*, form **vibrans** (*Fabricius ?*) Kirby. Not uncommon on the Island in August, 1894; much less common in July, 1895.

Libellula exilIena *Westwood*, form* **incesta** *Hagen*. July, August.

Libellula quadrimaculata *Linné*. Arlington, May 11, 1889, and plentiful June 19, 1893.

Libellula semifasciata *Burmeister*, April 25, 1896. May, June, July, August, September.

Libellula pulchella *Drury*. May, June, July, August, September.

Plathemis trimaculata *De Geer*. May, June, July, August, September.

Micrathyria berenice *Drury*. May, June, July, August. Often of a quiet summer evening countless numbers of this species will be seen settled on the grass stems in the salt meadows, in which position they spend the night. When they are particularly abundant the July crop of mosquitoes is speedily reduced in numbers, being devoured at headquarters.

Nannothemis bella *Uhler*. June and July, 1888, at the Four Corners iron mine ponds.

Celithemis elisa *Hagen*. June, July, August.

Celithemis eponina *Drury*. May, July.

Leucorhinia intacta *Hagen*. May, June.

Diplax rubicundula *Say*. July, August, September.

Diplax obtrusa *Hagen*. July.

Diplax semicincta *Say*. July 15, 1894. Four Corners iron mine ponds.

Diplax vicina *Hagen*. September, October, November. While my companion and I were sitting in the sun on October 21, 1892, five of these dragonflies at one time lit upon us, wishing to sun themselves also. Some lit on my hands—one on the end of my thumb. The dragonflies are most attracted if you have on light colored garments, or a newspaper spread on the ground is a favorite resting place.

Diplax corrupta *Hagen*. Shore at Eltingville, May 27, 1896. (See this JOURNAL, Vol. V, p. 95.)

Perithemis domitia *Drury*. June, July.

Mesothemis simplicicollis *Say*. June, July, August.

Pachydiplax longipennis *Burmeister*. June, July, August, September.

NOTE ON THE NEST OF VESPA CRABRO.

PLATES IX AND X.

By WILLIAM BEUTENMULLER.

The nest of this species, figured on Plate X, was found by Dr. E. G. Love, at Jamaica, Long Island. It was built in a hollow oak tree, and only had a small opening which was used as an entrance for the wasps. The figure is very much reduced; the nest is about two feet long and seven inches wide. The comb figured on Plate X is natural size and was taken from the middle part of the nest. In the American Museum of Natural History is a nest of *Crabro* from Germany, which is oblong oval, and constructed of a brittle, light brown wood pulp, from pine. It is an external nest, being covered with "paper" from which the resin exuded, giving it a variegated appearance. It evidently had been built between the rafters of a house. The top of nest is open, and shows traces of having been fastened at that end.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF NOVEMBER 2, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Fifteen members present.

Mr. C. F. Hartman was elected an active member.

Mr. Davis exhibited a pupa, pinned soon after the pupation, that had continued to develop, and the butterfly had emerged with the pin stuck through it. He stated that he had experimented with several species with the same result.

Mr. Doll exhibited several cases of rare North American Lepidoptera, and after a general discussion the meeting adjourned.

MEETING OF NOVEMBER 16, 1897.

Held at the residence of Mr. Miller, 141 East 40th Street.

The entire evening was devoted to an auction sale of insects for the benefit of the JOURNAL, and the sum of $117.00 was realized.

MEETING OF DECEMBER 7, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Fourteen members present.

Mr. Daecke stated that it would be advisable to arrange for a series of classes for beginners to foster an interest in the study of entomology, and thought that the Society ought to undertake this task.

Dr. Martin read a paper entitled "On Collecting in New York City Forty Years Ago." He stated that he began collecting insects in Albany, and then came to this city and collected for about ten years. He collected principally in Washington Square, which in the fifties was a very different place from the Washington Square of to-day. The trees were mostly poplar, buttonwood, locust and weeping willow. He gave a graphic description of the features, and also mentioned the following as some of the insects caught there: Two species of *Catocala*, *Vanessa antiopa*, *Grapta comma* and *interrogationis*, *Limenitis disippus*, a *Sesia*, much like *apiformis*, in the roots of poplar, *Brontes dubius*, *Saperda calcarata*, *Parandra brunnea*, *Dorcus parallelus*, *Pterostichus lucublandus*, *Neoclytus erythrocephalus*, *Caloides nobilis*, *Elaphrus ruscarius*, *Cotalpa lanigera*, several species of *Lachnosterna*, *Staphylinus*, *Chlænius*, *Harpalus* and also many *Hymenoptera* and *Diptera*. He stated that the black species of *Ophion* and *Pelecinus polycerator* were very common. Several species of *Agapostemon* on Althea flowers were also abundant. The canker-worms at that time swarmed over everything, but after the introduction of the English sparrow they gradually disappeared. *Calosoma scrutator*, *C. calidium* and *C. externum* were abundant and fed on the canker-worms. *Rhagium lineatum* was also to be found. He further stated that during that time *Oxacis dorsalis* was to be found at Sandy Hook under logs and pieces of wood.

Mr. Beutenmuller said that this insect was yet to be found at Sandy Hook near the old steamboat landing, and he also exhibited larvæ of *Eudæmonia argus* and *argiphontes*.

Mr. Southwick made a few remarks on his work in Central Park, and said that with a little more help at certain seasons of the year he could manage to get rid of the *Orygia leucostigma*.

Mr. Doll exhibited a fine series of *Schinia brevis* caught near Brooklyn. He also showed some striking varieties of *Vanessa antiopa* lacking the blue spots.

After discussion, adjournment.

JOURNAL

OF THE

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A CONTRIBUTION TO THE STUDY OF THE FAUNA OF THE GRAVE. A STUDY OF ON HUNDRED AND FIFTY DISINTERMENTS, WITH SOME ADDITIONAL EXPERIMENTAL OBSERVATIONS.

By Murray Galt Motter, B.S., M.A., M.D.

Volunteer in the United States Bureau of Animal Industry.

It were fitting, at the very outset of this report, to make acknowledgment of the kindly interest and assistance, through which alone the work was made possible: To Dr. Ch. Wardell Styles, Zoölogist of the Bureau of Animal Industry, U. S. Department of Agriculture, for the facilities of his laboratory; to the Entomologist, Dr. L. O. Howard, and his assistants, Messrs. Schwarz, Coquillett, Pergande, Banks, and Chittenden, and to Messrs. Simpson and Benedict, of the Smithsonian Institution, who, by their specific determinations and valued suggestions, have brought order out of the chaos of an amateur collector.

At the suggestion of Dr. Stiles, the work was undertaken to determine, if possible, the bearings of Mégnin's "Application of Entomology to Legal Medicine," in so far as they might be learned through a faunistic study of such disinterments as we should have access to, in and about the City of Washington. The collection and superficial differentiation of specimens were made by the writer, for the most part without assistance, it being found better to have all the observations made by the same individual. While, by this plan, less was accomplished in the way of collecting, what was done was done more thoroughly and uniformly. It is to be regretted that, owing to these circumstances, it was impossible to take fuller, more detailed notes of the general conditions observed in each disinterment.

This phase of the subject, the appearance and condition of the human cadaver, after varying periods of interment and under varying conditions, has received more or less scientific study for something over a hundred years at least. Beginning with the report, published in 1783, of the exhumations at Dunkerque, and continuing with Thouret's report of those by Fourcroy in 1789; Marc's article in the Dictionary of the Medical Sciences for 1815; the studies of Orfila and his associates, and the more recent studies of Bordas—throughout all, the difficulties and complications of the subject are seen to be such that, from the condition of the cadaver alone, no certain knowledge of the exact date of death is to be had.

Some of the conditions which influence and determine the process and progress of the decomposition of buried human cadavers would seem to be as follows: The age, sex, and perhaps even the race of the subject; the character and duration of the disease process to which he succumbed; the mode of death, whether quiet and peaceful or violent and painful; the season of the year at which this event occurs; the temperature and general conditions of the sick-room; the length of time intervening between death and burial; the attention given the corpse in the matter of cleaning, embalming and clothing; the kind of coffin in which it is placed, its internal fittings and external casings; the grave, its depth, the way it is prepared and filled, whether one or more interments be made in the same grave-site; the soil, its character physical and chemic, soil-temperature and soil-moisture; the general, physical, climatic and meteorologic conditions of the cemetery in which interment is made.

These are but some of the many factors which must be taken into consideration in the study of exhumed human cadavers. Just what weight should be given to each we seem, at present, utterly unable to determine. As in the study of the living, but diseased, subject, each case would seem to be a law unto itself; and our previous knowledge of apparently similar cases can afford suggestions only, not hard and fast rules. To illustrate, Barrett quotes from Orfila an exhumation, at Valenciennes, after fifteen years' interment, where "preservation was so perfect the inspectors were enabled to determine that the individual had not died a violent death, but of a peripneumony, complicated with a gastro-enteritis." In the following list will be found two cases (Nos. 7 and 8), in which, after but three years and six months, the skeletons were completely stripped and all soft tissues gone. Again,

Orfila, Goedart and others have been led to the conclusion that, other things being equal, the deeper the grave the slower the progress of decomposition. In two cases following (Nos. 58 and 59), buried within sixteen days of each other, after an interment of seven years and nine months, the skeleton at the bottom of the grave was found almost wholly stripped, while the upper one had still a heavy case of adipocere.

So varied and so numerous are the modifying conditions and circumstances that it is impossible to say, definitely and absolutely, what is the exact order of disappearance of the several organs and tissues. Looking at the problem from the opposite standpoint, it seems that the bones and the hair are the last to undergo disintegration. I have found the bones, after an interment of seventy-one years, still preserving their general form and appearance, though easily crushed between thumb and fingers; the hair I have seen practically intact after thirty-six years. The brain I have found a still recognizable grayish mass, lying within the skull after all the other soft tissues had disappeared and the skeleton had been completely disarticulated. Indeed, I have found it, after eighteen years and two months (No. 136), lying on the occipital bone after the skull itself had fallen apart. Strange to say, the spinal cord seems to disappear much earlier; I have failed to find any vestige of it—in one case (No. 6)—after three years and five months. The skin and the more superficial connective tissues of the trunk and extremities are converted into a sort of case of adipocere, which preserves the general outline of the cadaver long after the internal organs, and the muscles and tendons even have been completely destroyed and the skeleton within stripped and disarticulated. Under ordinary conditions of interment, some, at least, of this adipocere may persist for ten or twelve years, remaining longest about the pelvis and lower part of the abdomen. I have been able to recognize the skin, fasciæ, muscles, tendons, vessels and nerves of the thigh in one cadaver (No. 44) after six years and five months; while, on the other hand, in another case (No. 40) the muscles had entirely disappeared after six years and three months. In most of the cases observed, the thoracic and abdominal organs seem to have disappeared before the muscles. The face, hands and feet seem to be the first parts attacked; I recall at least one instance where the skull was entirely stripped while as yet there seemed to be but little change elsewhere.

In the following pages I have brought together, for the purpose of

a closer study and comparison, the notes of one hundred and fifty disinterments, made within the city limits of Washington, D. C., during the summers of 1896–97. The cases are arranged chronologically according to the period of interment of each, and the fauna is grouped systematically. The specimens will be deposited in the U. S. National Museum, at Washington, as the Stiles-Motter Collection of cadaveric fauna.

1.—1 yr. 11 mos. Grave 6 ft., moist; sandy. Erysipelas. Interred May 3, 1894.
Pseudoscorpiones, *Chelanops tristis* Bks., 14 specimens.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Atheta*, sp. (*Homalota?*), 1 specimen.
" " *Eleusis pallida* Lec., 2 specimens.
" Nitidulidæ, *Rhizophagus scalpturatus* Mann., 2 specimens.

2.—2 yrs. 10 mos. Grave 6 ft., coffin submerged; sand and clay. Interred July 14, 1894.
Thysanura, undetermined.
Diptera, Muscidæ, *Lucilia cæsar* Linn., puparia.
" Anthomyidæ, *Homalomyia*, sp.

3.—3 yrs. 1 mo. Grave 5 ft., wet; sand and clay. Hepatic abscess. Interred March 12, 1893.
Crustacea, *Armadillidium vulgare* Latr., 1 specimen.
Thysanura, undetermined.
Homoptera, Coccidæ, *Ripersia*, sp., in Phorid puparia.
Diptera, Phoridæ, puparia.

4.—3 yrs. 2 mos. Grave 6 ft., coffin submerged; sand and clay. Interred February 15, 1894.
Vermes, Lumbricid, undetermined.
Acarina, Gamasidæ, *Tyroglyphus*, sp.
Coleoptera, Staphylinidæ, *Actobius pæderoides* Lec., fragment.
" " *Pæderus littorarius* Grav., 3 specimens, two covered with undetermined fungus.
" " *Eleusis pallida* Lec., 160 specimens.
" Elateridæ, *Monocrepidius bellus* Say, 1 specimen.
Diptera, Stratiomyidæ, larva.
" Phoridæ, puparia.
" Sepsidæ, *Piophila casei* Linn., puparia.
" Borboridæ, wings (*Limosina?*).

5.—3 yrs. 3 mos. Grave 3 ft., dry; sandy. (Infant.) Congestion of lungs. Interred February 21, 1893.
Diptera, Phoridæ, puparia.

6.—3 yrs. 5 mos. Grave 5 ft., coffin submerged; sand and clay. Interred January 18, 1894.
Diptera, Muscidæ, *Compsomyia macellaria* Fabr., puparia.
Only a few of these puparia found. Thoracic and abdominal organs, neck and soft tissues of face and hands destroyed. Abdominal and chest walls almost intact. Ribs not yet disarticulated. Spinal cord gone.

7.—3 yrs. 6 mos. Grave 5 ft., moist; sand and clay. Pneumonia. Interred December 29, 1893.

Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.

Thysanura, undetermined.

Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., numerous.

Diptera, Phoridæ, puparia.

Mites, thysanura and beetles working together in slimy debris about thighs and pelvis. All soft tissues gone; some clothing still remaining.

8.— 3 yrs. 6 mos. Grave 5 ft., moist; sand and clay. Bronchitis. Interred December 17, 1893.

Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.

Thysanura, undetermined.

Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., fragments.

Diptera, Phoridæ, puparia.

All soft tissues gone; some clothing still left.

9.—3 yrs. 6 mos. Grave 5 ft., moist; sand and clay. Phthisis. Interred December 10, 1893.

Araneida, *Theridion subterranea* Bks., sp. n.

Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.

Thysanura, undetermined.

Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 2 specimens.

" " *Eleusis pallida* Lec., numerous.

Diptera, Sepsidæ, *Piophila casei* Linn., puparia.

Thysanura, beetles and larvæ working in layers of adipocere, lower abdominal wall and pelvis.

10.—3 yrs. 6 mo. Grave 5 ft., moist; sand and clay. Phthisis. Interred November 20, 1893.

Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.

Thysanura, undetermined.

Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., numerous, adults and larvæ.

Beetles and larvæ especially about pelvis.

11.—4 yrs. 1 mo. Grave 5 ft., moist; sand and clay. Phthisis. Interred June 13, 1893.

Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.

Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., larva.

" " *Eleusis pallida* Lec., 6 specimens.

Diptera, Muscidæ, *Lucilia cæsar* Linn., puparia in great numbers.

" Sepsidæ, *Piophila casei* Linn.

Skeleton completely stripped and disarticulated. Mites on bones. Beetles and larvæ from slime in bottom of coffin.

12.—4 yrs. 1 mo. Grave 5 ft., moist; sand and clay. Uræmia. Interred June 6, 1893.

Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.

Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., adult and fragments.

13.—4 yrs. 1 mo. Grave 5 ft., moist; sand and clay. Dropsy (!). Interred May 25, 1893.

Araneida, *Erigone albescens* Bks., sp. n.

Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Diptera, Phoridæ, puparia.
Hymenoptera, Myrmicidæ, *Monomorium minutum* Mayer.

14.—4 yrs. 1 mo. Grave 3 ft., dry, sandy. Phthisis. Interred May 24, 1893.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Thysanura, undetermined.
Diptera, Phoridæ, puparia.
" Muscidæ, *Lucilia cæsar* Linn., puparia.
" Sepsidæ, *Piophila casei* Linn., wing.
No coffin, only burial case used. Myriads of mites, thysanura and puparia. No beetles nor larvæ. Skeleton stripped.

15.—4 yrs. 1 mo. Grave 5 ft., moist; sand and clay. Bronchitis. Interred May 18, 1893.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Thysanura, undetermined.
Pseudoneuroptera, *Termes flavipes* Kollar.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., fragments.
" Larvæ, undetermined.
Diptera, Phoridæ, puparia.
One live staphylinid escaped (*Actobius ?*). Skeleton stripped and dry.

16.—4 yrs. 2 mos. Grave 5 ft., moist; sand and clay. Senility. Interred May 7, 1893.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 1 and larva.
" " *Lathrobium simile* Lec., 1 specimen.
Diptera, Phoridæ, puparia.
Few insects found. Skeleton completely stripped. Some clothing still remaining.

17.—4 yrs. 2 mos. Grave 5 ft., moist; sand and clay. Nephritis. Interred May 8, 1893.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 1 and larvæ.
" " *Eleusis pallida* Lec., numerous.
" Larvæ, undetermined.
Beetles and larvæ especially about pelvis; elsewhere all soft tissues gone.

18.—4 yrs. 3 mos. Grave 5 ft., moist; sand and clay. Valvular disease of heart. Interred May 14, 1893.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 1 specimen.
" " *Eleusis pallida* Lec., numerous.
" Larvæ, undetermined.
Fairly alive with mites, thysanura, beetles and larvæ, working on surface of cadaver, under clothing. Cadaver large and heavy; general outlines still well preserved by case of adipocere.

19.—4 yrs. 4 mos. Grave 5 ft., moist; sand and clay. Interred March 28, 1893.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.

Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., numerous.
" Larvæ, undetermined.

20.—4 yrs. 5 mos. Grave 4 ft., moist; sand and clay. Interred January 24, 1893.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 1 specimen.
" " *Lathrobium*, sp., head of larva.
" Larvæ, undetermined.
Diptera, Sepsidæ, *Piophila casei* Linn., puparia.
A number of very minute, silvery thysanura, so active that it was almost impossible to take them.

21.—4 yrs. 10 mos. Grave 4 ft., moist; sand and clay. (Infant.) Diarrhœa. Interred September 6, 1892.
Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 1 specimen.
" " *Eleusis pallida* Lec., 7 specimens.
" Larvæ, undetermined.
Coffin filled with mud and slime.

22.—4 yrs. 11 mos. Grave 3 ft., moist; sand and clay. Cholera infantum. Interred August 9, 1892.
Coleoptera, larvæ, undetermined.
Bones almost disintegrated. Specimens from wood of bottom of coffin.

23.—5 yrs. Grave 6 ft., wet loose clay. Rheumatism. Interred April 17, 1891.
Thysanura, *Isotoma*, sp.
Coleoptera, Curculionidæ, larva (*Sphenophorus ?*).

24.— 5 yrs. Grave 5 ft., coffin submerged; sand and clay. Typhoid. Interred May 13, 1891.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec.

25.—5 yrs. Grave 6 ft., wet, sandy. Phthisis. Interred April 23, 1891.
Thysanura, undetermined.

26.—5 yrs. 3 mos. Grave 5 ft., wet; sand and clay. Interred April 5, 1892.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 8 specimens.

27.—5 yrs. 3 mos. Grave 5 ft., moist; sand and clay. Congestion of brain. Interred March 22, 1892.
Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 1 specimen.
" " *Eleusis pallida* Lec., numerous.
" Larvæ, undetermined.
Considerable adipocere on legs and pelvis.

28.—5 yrs. 3 mos. Grave 5 ft., coffin submerged; sand and clay. Interred March 10, 1892.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., numerous.

29.—5 yrs. 4 mos. Grave 5 ft., wet; sand and clay. Typhoid. Interred March 9, 1892.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Coleoptera, Staphylinidæ, *Homalota*, sp., 5 specimens.
" " *Actobius umbripennis* Lec., fragments.

Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., numerous and fragments.
" Larvæ, undetermined.
Beetles found working in layers of adipocere and within the bones.

30.—5 yrs. 4 mos. Grave 5 ft., coffin submerged; sand and clay. Cardiac dropsy. Interred February 2, 1892.
Thysanura, undetermined.
Nothing left but the bones and some of them softened.

31.—5 yrs. 4 mos. Grave 5 ft., wet; sand and clay. Interred February 4, 1892.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., numerous.
Hymenoptera, Myrmicidæ, *Cremastogaster lineolata* Say.

32.—5 yrs. 4 mos. Grave 5 ft., moist; sand and clay. Interred February 29, 1892.
Thysanura, in great numbers, undetermined.
Coleoptera, Carabidæ, *Harpalus faunus* Say, 1 specimen.
" Staphylinidæ, fragments (*Eleusis ?*).
The carabid beetle was probably accidental.

33.—5 yrs., 4 mos. Grave 3 ft., moist; sand and clay. (Infant.) Phthisis. Interred February 22, 1892.
Myriapod, larva.
Coleoptera, Staphylinidæ, larva (*Philonthus ?*).
" Nitidulidæ, *Rhizophagus scalpturatus* Mann., 7 specimens.
Skeleton completely stripped and dry; some clothing still remaining.

34.—5 yrs., 5 mos. Grave 5 ft., wet; sand and clay. Pneumonia. Interred January 18, 1892.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 1 specimen.
" " *Eleusis pallida* Lec., 2 and fragments.

35.—5 yrs. 5 mos. Grave 5 ft., wet; sand and clay. Peritonitis. Interred January 18, 1892.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., numerous.
" Larvæ undetermined.
Beetles and larvæ burrowing in adipocere and soft bones.

36.—5 yrs. 5 mos. Grave 5 ft., wet; sand and clay. Cerebral congestion. Interred January 18, 1892.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., fragments.
Diptera, Phoridæ, puparia.
Probably embalmed. Soft tissues almost disappeared.

37.—5 yrs. 5 mos. Grave 5 ft., moist; sand and clay. Consumption. Interred January 24, 1892.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 2 and fragments.

Coleoptera, Nitidulidæ, *Rhizophagus scalpturatus* Mann., 1 specimen.
" Larvæ, undetermined.

38.—6 yrs. Grave 5 ft., moist; sandy. (Infant.) Tuberculosis. Interred June 31, 1891.
Pseudoscorpiones, *Chelanops tristis* Bks.
Myriapoda, undetermined.
Diptera, Phoridæ, puparia, in great numbers.

39.—6 yrs. 2 mos. Grave 5 ft., moist; sand and clay. Pneumonia. Interred April 22, 1891.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Homalota*, sp., 1 specimen and larva.
" " *Eleusis pallida* Lec., numerous.
" Nitidulidæ, *Rhizophagus scalpturatus* Mann.
Soft tissues almost disappeared. Beetles in great numbers about patella and sternum.

40.—6 yrs. 3 mos. Grave 5 ft., coffin submerged; sand and clay. Pneumonia. Interred April 2, 1891.
Thysanura, in great numbers, undetermined.
No other insects seen. While grave was wet, cadaver had evidently been mummified. Skeleton stripped and disarticulated; muscles almost disappeared, only an outer shell of adipocere which preserved general outline of cadaver.

41.—6 yrs. 5 mos. Grave 6 ft., coffin submerged; sand and clay. Interred December 26, 1890.
Thysanura, undetermined.
Diptera, Sepsidæ, *Piophila casei* Linn., puparia.

42.—6 yrs. 5 mos. Grave 5 ft., coffin submerged; sand and clay. Phthisis. Interred January 23, 1891.
Thysanura, undetermined.
Coleoptera, fragments, undetermined.
Diptera, Phoridæ (?), puparium.
Nothing but hard bones left.

43.—6 yrs. 5 mos. Grave 5 ft., wet; sand and clay. Senile debility. Interred February 1, 1891.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 1 specimen.
" " *Eleusis pallida* Lec., numerous.
" Larvæ, undetermined.
All soft tissues gone. Thysanura, beetles and larvæ working inside the bones, entering through nutrient canals, etc.

44.—6 yrs. 5 mos. Grave 5 ft., coffin submerged; sand and clay. Senile debility. Interred February 2, 1891.
Thysanura, undetermined.
Thoracic and abdominal cavities emptied; lower ends of limbs (upper and lower) stripped. Tissues (skin, fasciæ, muscles, tendons, vessels and nerves) still distinguishable about thighs.

45.—6 yrs. 9 mos. Grave 6 ft., coffin submerged; sand and clay. Cerebral embolism. Interred August 8, 1889.
Thysanura, undetermined.

46.—6 yrs. 11 mos. Grave 4 ft., coffin submerged; sand and clay. Interred May 18, 1890.
Myriapoda, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 2 specimens.
Diptera, Sepsidæ, *Piophila casei* Linn., puparia.

47.—7 yrs. Grave 4 ft., moist; sand and clay. Still-born. Interred July 28, 1890.
Gastropoda, *Helicodiscus lineatus* Say.
Crustacea, undetermined.
Araneida, *Theridion subterranea* Bks., sp. n.
Thysanura, undetermined.
Diptera, Phoridæ, puparia.
Smaller bones, skull, etc., almost disintegrated and pulverizable. Snails from coffin lid; spider and a few thysanura inside.

48.—7 yrs. Grave 5 ft., moist; sand and clay. Interred ——— —— 1889.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 3 and larvæ.
" " *Eleusis pallida* Lec., numerous.
" " Undetermined, covered with fungus.
" Larvæ, undetermined.
Skeleton stripped and disarticulated lying within shell of adipocere. Clothing fairly preserved.

49.—7 yrs. 4 mos. Grave 5 ft., coffin submerged; sand and clay. Interred December 16, 1889.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 2 specimens.

50.—7 yrs. 4 mos. Grave 5 ft., moist; sand and clay. Typhoid. Interred May 5, 1890.
Araneida, *Theridion subterranea* Bks., sp. n.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec.
" Larvæ, undetermined.
Diptera, Sepsidæ, *Piophila casei* Linn., puparia.
" Borboridæ, *Limosina ?* wings.
Hymenoptera, Myrmicidæ, *Aphenogaster*, sp.
Skeleton completely stripped and disarticulated. Black, wet, powdery debris in bottom of coffin, alive with mites, thysanura and a few larvæ.

51.—7 yrs. 4 mos. Grave 5 ft., moist; sand and clay. Valvular disease of heart. Interred March 4, 1890.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec.
" Larvæ, undetermined.
Thorax not yet evacuated. Heavy case of adipocere; within, skeleton pretty well cleaned.

52.—7 yrs. 7 mos. Grave 5 ft., moist; sand and clay. Exposure to cold (!). Interred December 7, 1889.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., fragments.
Skeleton completely stripped.

53.—7 yrs. 7 mos. Grave 5 ft., moist; sand and clay. Inanition. Interred December 13, 1889.
Acarina, Gamasidæ, *Uropoda depressa* Bks., sp. n.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., fragments.
" Larvæ, undetermined.
Diptera, Phoridæ, puparia.
Skeleton stripped.

54.—7 yrs. 8 mos. Grave 5 ft., moist; sand and clay. Intermittent fever. Interred November 15, 1889.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., fragments.
Skeleton stripped. Coffin dry inside, completely overgrown with roots.

55.—7 yrs. 8 mos. Grave 5 ft., wet, sand and clay. Obstruction of bowels. Interred November 10, 1889.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 2 specimens.
" Larvæ, undetermined.
Skeleton stripped.

56.—7 yrs. 8 mos. Grave 5 ft., moist; sand and clay. Accident. Interred October 7, 1889.
Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec.
" " *Eleusis pallida* Lec.
Skeleton stripped and disarticulated; adipocere almost consumed.

57.—7 yrs. 9 mos. Grave 3 ft., moist; sand and clay. Diphtheria. Interred October 17, 1889.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 6 specimens.
" Larvæ, undetermined.
Skeleton stripped and disarticulated, lying within heavy case of adipocere which was very black on surface. Many *Eleusis* dead on outside of coffin.
This cadaver in same grave with 58.

58.—7 yrs. 9 mos. Grave 5 ft., moist; sand and clay. Diphtheria. Interred October 1, 1889.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 1 specimen.
" " *Eleusis pallida* Lec., numerous.
" Larvæ, undetermined.
Very little adipocere left. This buried in same grave underneath No. 57.

59.—7 yrs. 10 mos. Grave 5 ft., moist; sand and clay. Dysentery. Interred September 24, 1889.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 2 specimens.
Coffin too full of earth to examine thoroughly. Specimens from skull.

60.—7 yrs. 10 mos. Grave 5 ft., moist; sand and clay. Pneumonia. Interred September 16, 1889.

Thysanura, in great numbers, undetermined.

Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 2 specimens.

Cadaver large and heavy; outlines preserved by heavy case of adipocere, skeleton within stripped.

61.—7 yrs. 10 mos. Grave 5 ft., moist; sand and clay. Heart disease (!). Interred September 14, 1889.

Thysanura, in great numbers, undetermined.

Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 8 specimens.

Many *Eleusis* on coffin lid, outside and in. Skull entirely stripped; heavy case of adipocere below this; within, skeleton stripped.

62.—8 yrs. 2 mos. Grave 5 ft., moist; sand and clay. Convulsions (!). Interred May 5, 1889.

Thysanura, undetermined.

Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 3 specimens.

" " *Eleusis pallida* Lec., numerous.

" " Larvæ (*Eleusis ?*).

" Nitidulidæ, *Rhizophagus scalpturatus* Mann., numerous.

Upper half of cadaver completely stripped. Myriads of thysanura, beetles and larvæ on lower half, on and under clothing and in adipocere.

63.—8 yrs. 2 mos. Grave 5 ft., moist; sand and clay. Phthisis. Interred April 27, 1889.

Thysanura, undetermined.

Coleoptera, Staphylinidæ, *Eleusis pallida* Lec.

Bones completely stripped; but one beetle and few thysanura seen.

64.—8 yrs. 2 mos. Grave 5 ft., moist; sand and clay. Debility (!). Interred May 3, 1889.

Thysanura, undetermined.

Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., 1 specimen.

" " *Eleusis pallida* Lec., numerous.

" Nitidulidæ, *Rhizophagus scalpturatus* Mann., 4 specimens.

" Larvæ, undetermined.

Thysanura, beetles and larvæ in layers of adipocere, about pelvis, and on skull under hair.

65.—8 yrs. 3 mos. Grave 5 ft., wet; sandy. (Infant.) Malnutrition. Interred February 2, 1888.

Thysanura, undetermined.

66.—9 yrs. 4 mos. Grave 6 ft., coffin submerged; sand and clay. Interred January 27, 1888.

Thysanura, undetermined.

Diptera, Sepsidæ, *Piophila casei* Linn., puparia.

67.—9 yrs. 9 mos. Grave 5 ft., moist; sand and clay. Phthisis. Interred September 18, 1887.

Thysanura, undetermined.

Coleoptera, Staphylinidæ, *Lathrobium simile* Lec., 3 specimens.

" " *Eleusis pallida* Lec., 6 specimens.

Diptera, Phoridæ, puparia.

68.—10 yrs. Grave 5 ft., wet; sand and clay. Phthisis. Interred July 7, 1887.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 3 and fragments.
" Fragments, undetermined.
Diptera, Phoridæ, puparia.

69.—10 yrs. Grave 5 ft., moist; sand and clay. Diarrhœa. Interred July 14, 1887.
Crustacea, undetermined.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Homalota*, sp.
" " *Eleusis pallida* Lec.
" Larvæ, undetermined.
Diptera, Phoridæ, puparia.
Thysanura, beetles and larvæ burrowing in wood of coffin, in layers of adipocere, and in cancellated bone tissue, sternum, patella, etc.

70.—10 yrs. 2 mos. Grave 4 ft., coffin submerged; sand and clay. (Infant.) Marasmus. Interred April 25, 1887.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 10 specimens.

71.—10 yrs. 3 mos. Grave 5 ft., coffin submerged; sand and clay. Phthisis. Interred March 6, 1887.
Thysanura, undetermined.

72.—10 yrs. 3 mos. Grave 6 ft., coffin submerged; sand and clay. Interred March 9, 1887.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec.
Diptera, Sepsidæ, *Piophila casei* Linn., puparia.
Pupæ apparently viable when taken but failed to breed in the laboratory.

73.—10 yrs. 4 mos. Grave 5 ft., coffin submerged; sand and clay. Cholera. Interred February 15, 1887.
Gastropoda, *Helicodiscus lineatus* Say.
Vermes, undetermined.
Crustacea, *Armadillidium ?*
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 3 specimens.

74.—10 yrs. 7 mos. Grave 9 ft., damp; loose sand. Tetanus. Interred September 21, 1885.
Crustacea, *Armadillidium vulgare* Ltr., 3 specimens.
Thysanura, *Isotoma*, sp.

75.—10 yrs. 8 mos. Grave 5 ft., coffin submerged; sand and clay. Consumption. Interred September 23, 1886.
Thysanura, undetermined.
Coleoptera; Nitidulidæ, *Rhizophagus scalpturatus* Mann., 7 specimens.

76.—10 yrs. 8 mos. Grave 6 ft., coffin submerged; sand and clay. Consumption. Interred October 3, 1886.
Thysanura, undetermined.

77.—11 yrs. 2 mos. Grave 5 ft., coffin submerged; sand and clay. Hepatic colic. Interred April 8, 1886.

Thysanura, undetermined

Coleoptera, Staphylinidæ, *Eleusis pallida* Lec.

78.—12 yrs. 11 mos. Grave 6 ft., dry; sandy. Phthisis. Interred July 27, 1883.

Crustacea, undetermined.

Araneida, *Bathyphantes*, sp. n.; *Cicurina arcuata* Keys.

Myriapoda, *Isobates* (*I. minutus* Brandt?).; *Iulus*, sp.

Pseudoneuroptera, *Termes flavipes* Kollar, 7 specimens.

Coleoptera, Staphylinidæ, larva undetermined.

" Nitidulidæ, *Rhizophagus scalpturatus* Mann., fragments.

Diptera, Phoridæ, puparia.

79.—15 yrs. 5 mos. Grave 7 ft., dry; sandy. (Infant.) Diphtheria. Interred December 17, 1880.

Araneida, *Cicurina creber* Bks.

Myriapoda, *Iulus*, sp., numerous.

Coleoptera, Staphylinidæ, *Staphylinus cinnamopterus* Grav., 2 specimens, probably accidental, found outside coffin in grave.

Diptera, Phoridæ, puparia.

80.—15 yrs. 10 mos. Grave 4 ft., coffin submerged; sand and clay. Interred September 29, 1881.

Thysanura, undetermined.

Coleoptera, Carabidæ, *Schizogenius amphibius* Hald., fragments, probably accidental.

Diptera, Phoridæ, puparia.

81.—16 yrs. 5 mos. Grave 9 ft., moist; sand. Apoplexy. Interred January 18, 1881.

Gastropoda, *Zonitoides minusculus* Binn.

Vermes, undetermined.

Crustacea, undetermined.

Pseudoscorpiones, *Chelanops tristis* Bks.

Araneida, *Circurina creber* Bks.; *Theridion subterranea* Bks., sp. n.; *Erigone albescens* Bks., sp. n.

Myriapoda, undetermined.

Thysanura, undetermined.

Coleoptera, Pselaphidæ, *Batrisus* (*ferox ?*).

" Nitidulidæ, *Rhizophagus scalpturatus* Mann., fragments.

Diptera, Phoridæ, puparia.

Hymenoptera, Formicidæ, *Lasius flavus* De Geer.

Dry disarticulated bones and portion of coat lying in brown, powdery debris, fairly swarming with the above animals.

82.—18 yrs. 11 mos. Grave 3 ft., dry; sandy. (Infant.) Aphtha. Interred January 18, 1879.

Crustacea, undetermined.

Araneida, *Bathyphantes*, sp. n.

Myriapoda, *Isobates* (*I. minutus* Brandt?) numerous; *Iulus*, sp.

83.—20 yrs. Grave 3 ft., dry; sandy. (Infant.) Gastritis. Interred June 26, 1876.

Vermes, undetermined.
Crustacea, undetermined.
Myriapoda, *Isobates* (*I. minutus* Brandt?); *Iulus*, sp.
Diptera, Phoridæ, puparia.

84.—20 yrs. Grave 9 ft., dry; sandy. Enteritis. Interred May 9, 1876.

Diptera, Phoridæ, puparia.

85.—20 yrs. 3 mos. Grave 5 ft., dry; sandy. (Infant.) Meningitis. Interred February 14, 1876.

Myriapoda, *Isobates* (*I. minutus* Brandt?); *Iulus*, sp.
Diptera, Phoridæ, puparia.

86.—20 yrs. 7 mos. Grave 4 ft., dry; sandy. (Infant.) Pertussis. Interred August 8, 1875.

Gastropoda, *Vitrea electrina* Gould.
Thysanura, *Japyx* (*J. subterraneus* Pack.?).
Diptera, Phoridæ, puparia.

87.—20 yrs. 9 mos. Grave 6 ft., dry, sandy. (Infant.) Diarrhœa. Interred August 26, 1875.

Myriapoda, *Iulus*, sp.
Coleoptera, Carabidæ, *Dicælus ovalis* Lec., 1 specimen. Probably accidental, from bottom of grave.
" Elateridæ, larvæ, undetermined, fragment.
Diptera, Phoridæ, puparia.

88.—21 yrs. Grave 3 ft., dry; sandy. (Infant.)

Gastropoda, *Zonitoides minusculus* Binn.
Vermes, undetermined.
Myriapoda, *Isobates* (*I. minutus* Brandt?); *Iulus*, sp.
Diptera, Phoridæ, puparia.

89.—21 yrs. Grave 3 ft., dry, sandy.

Gastropoda, *Helicodiscus lineatus* Say.
Araneida, *Theridium*, sp. (*T. subterranea* Bks.?).
Myriapoda, *Isobates* (*I. minutus* Brandt?); *Iulus*, sp.; *Striaria*, sp.; *Scolopocryptops sexspinosa* Say.
Coleoptera, Trogositidæ, *Tenebrioides laticollis* Horn. Fragments.
Diptera, Phoridæ, puparia.

90.—21 yrs. Grave 3 ft., dry, sandy. (Infant.)

Myriapoda, *Iulus*, sp.
Diptera, Phoridæ, puparia.

91.—21 yrs. Grave 4 ft., dry, sandy. (Infant.)

Gastropoda, *Helicodiscus lineatus* Say.
Myriapoda. *Isobates* (*I. minutus* Brandt?).
Coleoptera, Pselaphidæ, *Batrisus ferox* Lec.
Diptera, Phoridæ, puparia.

92.—21 yrs. Grave 4 ft., dry, sandy. (Infant.)

Myriapoda, *Isobates* (*I. minutus* Brandt?); *Iulus*, sp.
Diptera, Phoridæ, puparia.

93.—21 yrs. Grave 4 ft., dry, sandy. (Infant.)
Gastropoda, *Helicodiscus lineatus* Say.
Araneida, *Cicurina creber* Bks.
Myriapoda, *Isobates* (*I. minutus* Brandt?); *Iulus*, sp.
Coleoptera, Scarabæidæ, *Lachnosterna*, sp. Probably accidental.
Diptera, Phoridæ, puparia.
Hymenoptera, Formicidæ, *Brachymyrmex heeri* Forel.
" Poneridæ, *Ponera contracta* Latr.
" Myrmicidæ, *Myrmicina latreilli* André.

94.—21 yrs. Grave 6 ft., dry, sandy. (Infant.)
Myriapoda, *Iulus*, sp.
Diptera, Phoridæ, puparia.

95.—21 yrs. Grave 6 ft., dry, sandy. (Infant.)
Gastropoda, *Helicodiscus lineatus* Say.
" *Zonitoides minusculus* Binn.
Araneida, *Lophocarenum*, sp.
Myriapoda, *Isobates* (*I. minutus* Brandt?); *Iulus*, sp.
Thysanura, *Lepidocyrtus*, sp.
Diptera, Phoridæ, puparia.

96.—21 yrs. Grave 6 ft., dry, sandy. (Infant.)
Araneida, Agalenidæ (*Cicurina?*).
Myriapoda, *Isobates* (*I. minutus* Brandt?); *Iulus*, sp.
Diptera, Phoridæ, puparia.

97.—27 yrs. Grave 8 ft. dry, sandy. (Infant.) Interred November 2, 1869.
Myriapoda, undetermined.
Diptera, Phoridæ, puparia. (*Conicera?*)

98.—29 yrs. 1 mo. Grave 6 ft., dry, sandy. (Infant.) Interred May 25, 1867.
Araneida, *Argiope*, sp.
Hymenoptera, Formicidæ, *Lasius americanus* Emery.

99.—38 yrs. 4 mos. Grave 6 ft., dry; sandy. Interred June 29, 1861.
Araneida, *Cicurina creber* Bks.
Acarina, Gamasidæ, *Gamasus*, sp.
Myriapod, undetermined.
Diptera, Phoridæ, puparia (*Conicera?*).

100.—71 yrs. Grave 6 ft., dry; sandy.
Gastropoda, *Heliocodiscus lineatus* Say.
Acarina, *Hypopus*, sp.
Bones dry and crumbling; rib picked up by its sternal end broke and crushed in falling by its own weight. Oscalcis, astragalus, head of femur, etc., crushed with little or no pressure. Wood of coffin dry and crumbling; medullary rays beautifully and clearly outlined; penetrated, more especially through long diameter, by numerous dead, dry, filamentous roots. Knots curiously demarcated and encapsulated. All dry, brown and pulverulent.

Note 1. Numbers 88–96 inclusive were interred prior to 1875, before the cemetery records were fully kept.

2. Numbers 5, 38, 74, 78, 79, 81–99 inclusive, are especially noteworthy on account of the unusual method of interment followed in the cemetery from which all were taken. Here, in every instance, each separate burial case is inclosed in a four-inch brick wall, laid in cement, and covered with stone or slate slabs, likewise sealed with cement, thus making what is practically a vault for each interment. This, it would seem, would prove an almost impenetrable barrier to the necrophagous fauna. It must be remembered, however, that, no matter how carefully prepared and laid, this cement, sooner or later, disintegrates; and that, save where two or more interments are made in the same grave-site—as is here not infrequently the case—the bottom of these vault-chambers is of earth, not of brick or stone. But, even where one vault is built on top of another, the crumbling cement leaves interstices between the bricks, through which, as we have seen, come diverse sorts of animals.

The following list of fifty cases includes those in which the examination was, for one reason or another, incomplete, the records fragmentary or unreliable, or the specimens lost.

101.—5 mos. Grave 6 ft., dry; sandy. Pneumonia. Interred January 22, 1896.
No insects found. Body embalmed and in good state of preservation. Slight whitish fungus over lower part of face and hands.

102.—1 yr. 2 mos. Grave 4 ft., moist; sand. Gastro-enteritis. Interred April 29, 1896.
On outside of coffin, chelifer, spider and thysanura; inside no insects found. Cadavar embalmed, tissue leathery, covered with thick, white, felt-like fungus.

103.—3 yrs. Grave 6 ft., dry; sandy. Consumption. Interred May 11, 1894.
Chelanops tristis Bks. and thysanura on outside of coffin. No insects inside. Body embalmed. Bones of skull clean, covered with thick, white fungus. Examination interrupted.

104.—3 yrs. 3 mos. Grave 7 ft., day; sandy. Asphyxia. Interred July 20, 1893.
Body embalmed and well preserved. Face and hands covered with thick, white fungus. No insects found.

105.—4 yrs. Grave 5 ft., moist; sand and clay. Interred July 14, 1893.
Had not sufficient time to examine thoroughly. Fragments of numerous staphylinids (*Eleusis pallida* Lec.?) no specimens taken.

106.—4 yrs. 1 mo. Grave 5 ft., coffin submerged; sand and clay. Valvular disease heart. Interred May 1, 1893.
Too wet to handle. Coffin contained embalming fluid. Skull stripped, some adipocere still remaining on lower limbs.

107.—4 yrs. 2 mos. Grave 3 ft., moist; sand and clay. Still-born. Interred April 24, 1893.
Gastropoda, *Helicodiscus lineatus* Say.
Diptera, Sepsidæ, *Piophila casei* Linn., puparia.

108.—4 yrs. 4 mos. Grave 3 ft., moist; sand and clay. (Infant.) Interred March 11, 1893.

A few thysanura only. Everything but the disarticulated bones gone. Coffin dry inside; roots and grasses growing up through bones and remnants of clothing.

109.—4 yrs. 7 mos. Grave 5 ft., coffin submerged; sand and clay. Pneumonia. Interred December 12, 1892.

Thysanura only. Considerable adipocere left. Intestines not yet destroyed. In vault 1 month.

110.—5 yrs. 3 mos. Grave 6 ft., coffin submerged; sand and clay. Interred February 29, 1892.

Thysanura only. In vault 2 months.

111.—5 yrs. 4 mos. Grave 5 ft., coffin submerged; sand and clay. Cholera. Interred February 26, 1892.

Thysanura and staphylinid fragments, specimens lost. Heavy case of adipocere, swarming with Thysanura.

112.—5 yrs. 5 mos. Grave 5 ft., coffin submerged; sand and clay. Pneumonia. Interred January 2, 1892.

Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec.

113.—6 yrs. 2 mos. Grave 5 ft., moist; sand and clay. Paralysis. Interred April 28, 1891.

Coffin too much broken in removal to be accurate about contents.

114.—6 yrs. 5 mos. Grave 5 ft., coffin submerged; sand and clay. Inflammation bowels. Interred February 9, 1891.

No insects, *not even Thysanura!*

115.—6 yrs. 5 mos. Grave 5 ft., coffin submerged; sand and clay. Pneumonia. Interred February 2, 1891.

Skeleton completely disarticulated, even skull, which contained pultaceous brain mass. Little adipocere left.

116.—6 yrs. 7 mos. Grave 5 ft., coffin submerged; sand and clay. Interred December 18, 1890.

No insects found. Clothing almost intact. Skeleton stripped and disarticulated.

117.—6 yrs. 9 mos. Grave 5 ft., coffin submerged; sand and clay. Typhoid. Interred September 7, 1890.

Thysanura only.

118.—7 yrs. 3 mos. Grave 9 ft., dry; sandy. Hemorrhage from lungs. Interred July 27, 1889.

Thysanura and acarids. Specimens lost.

119.—7 yrs. 5 mos. Grave 5 ft., coffin submerged; sand and clay. Membraneous croup. Interred January 20, 1890.

Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., fragment, covered with undetermined fungus.

" " *Eleusis pallida* Lec.

120.—7 yrs. 5 mos. Grave 5 ft., moist; sand and clay. Phthisis. Interred February 27, 1890.

Thysanura, undetermined.

Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., one dead covered with white fungus.
" " *Eleusis pallida* Lec.
" " Undetermined.
Diptera, Sepsidæ, *Piophila casei* Linn., puparia.
" Borboridæ, *Limosinia*, sp., wings.
Skeleton completely stripped, no adipocere left.

121.—7 yrs. 5 mos. Grave 5 ft., moist; sand and clay. Chronic diarrhœa. Interred February 24, 1890.
Gastropoda, *Helicodiscus lineatus* Say.
" *Zonitoides arboreus* Say.
Araneida, *Theridion subterranea* Bks., sp. n.
Coleoptera, larvæ, undetermined.
Diptera, Sepsidæ, *Piophila casei* Linn., puparia.
Skeleton completely stripped.

122.—7 yrs. 7 mos. Grave 6 ft., coffin submerged; sand and clay. Interred September 15, 1889.
Skeleton completely stripped and disarticulated; bones solid and black as ebony, some small detached masses of adipocere still remaining in coffin.
Not a sign of an insect to be found.

123.—7 yrs. 10 mos. Grave 5 ft., moist; sand and clay.
Coffin crushed in and full of earth, no specimens taken.

124.—7 yrs. 10 mos. Grave 5 ft., moist; sand and clay.
Coffin crushed in and full of earth, no specimens taken.

125.—8 yrs. 4 mos. Grave 5 ft., coffin submerged; sand and clay. Congestion brain. Interred March 9, 1889.
In vault 1 month. Skeleton completely stripped; a few masses of adipocere left from lower abdominal walls. No specimens taken.

126.—10 yrs. 1 mo. Grave 5 ft., coffin submerged; sand and clay. Dropsy (!).
Examined by assistant, no specimens.

127.—10 yrs. 1 mo. Grave 5 ft., coffin submerged.
Coleoptera, Staphylinidæ, *Actobius umbripennis* Lec., fragments.

128.—10 yrs. 2 mos. Grave 5 ft., coffin submerged; sand and clay. Interred April 3, 1887.
A few Thysanura only. No specimens taken.

129.—11 yrs. Grave 5 ft., dry; sandy. Still-born. Interred October 24, 1885.
Diptera, Phoridæ, puparia (*Conicera ?*), specimens lost.

130.—11 yrs. Grave 5 ft., wet; sandy.
Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec.

131.—11 yrs. 7 mos. Grave 5 ft., wet; sandy. Tetanus. Interred November 1884.
Araneida, *Lepthyphantes*, sp.
Pseudoneuroptera, *Termes flavipes* Kollar.
Diptera, Phoridæ, puparia.
In vault three months. Ob. 30, VIII, 84.

132.—12 yrs. 3 mos. Grave 6 ft., coffin submerged; sand and clay. Phthisis. Interred February 29, 1884.

Thysanura only. In vault 1 month.

133.—14 yrs. 5 mos. Grave 6 ft., dry "rotten rock." Peritonitis. Ob. 5, IX, 81, Mass. Interred November 22, 1881, D. C.

Diptera, Phoridæ, puparia.

Cadaver mummified, surface moist, skin and appendages practically intact. Coffin in tin-lined case, top tacked on.

134.—14 yrs. 8 mos. Grave 5 ft., dry, sandy. Hydrocephalus. Interred March 3, 1882.

Diptera, Phoridæ, puparia (*Conicera ?*), specimens lost.

135.—16 yrs. Grave 9 ft., dry, sandy. Œdema of lungs. Interred October 9, 1880.

Thysanura only. In vault 9 days.

136.—18 yrs. 2 mos. Grave 5 ft., coffin submerged; sand and clay. Interred May 13, 1879.

No insects save a few Thysanura on inner side of coffin. Skeleton completely stripped and disarticulated. Some grayish brain matter still left within disarticulated skull.

137.—18 yrs. 3 mos. Grave 5 ft., coffin submerged; sand and clay. Membraneous Croup. Interred February 2, 1878.

No insects found.

138.—19 yrs. 2 mos. Grave 6 ft., dry, sandy. Bright's disease. Ob. 9, I, 77. Interred April 17, 1877.

Gastropoda, *Helicodiscus lineatus* Say.

Araneida, *Lophocarenum*, sp.; *Lycosa*, sp.

Hymenoptera, Formicidæ, *Camponotus melleus* Say.

139.—20 yrs. 3 mos. Grave 5 ft., wet, sand and clay. Phthisis. Interred Apr. 5, 1876.

No insects found.

140.—24 yrs. 5 mos. Grave 5 ft., dry, sandy. Dysentery. Ob. 13, III, 72. Interred May 25, 1872.

Gastropoda, *Helicodiscus lineatus* Say.

Araneida, *Cicurina creber* Bks.

Acarina, *Hypopus*, sp.

Myriapoda, *Isobates* (*I. minutus* Brandt ?); *Iulus*, sp.

Thysanura, undetermined.

Diptera, Phoridæ, puparia (*Conicera ?*).

In vault two months.

141.—28 yrs. Grave 9 ft., dry, sandy. Pneumonia. Ob. 25, IX, 68, N. J. Interred April 25, 1884, D. C.

Crustacea, undetermined.

Pseudoscorpiones, *Chelanops tristis* Bks.

Araneida, *Theridium tepidariorum* Koch.

Acarina, Gamasidæ, *Hypoaspis*, sp.

Myriapoda, *Isobates* (*I. minutus* Brandt ?); *Iulus*, sp.

Thysanura, *Emtomobrya*, sp.

Coleoptera, Pselaphidæ, *Batrisus globosus* Lec.

" Nitidulidæ, *Rhizophagus scalpturatus* Mann.

Diptera, Drosophilidæ, *Drosophila ampelophila* Loew, probably accidental.

142.—36 yrs. No insects found.
143.—36 yrs. (Infant.) No insects found.
144.—36 yrs. (Infant.) No insects found.
145.—56 yrs. (Infant.) No insects found.
146.—Coffin so decayed and grave so wet, no definite results obtainable.
147.—Coffin so decayed and grave so wet, no definite results obtainable.
148.—Murder case, coffin filled with all sorts of rubbish; not examined.
149.—Negro, aet. 18 yrs. (?) drowned, 7th St. wharf, August 29th. Body recovered August 30th, inclosed in tin-lined case August 31st. Examined at Morgue September 2d. Larvæ taken from hair, face and clothing, September 16th bred:

Diptera, Muscidæ, *Compsomyia macellaria* Fabr.
" " *Lucilia cæsar* Linn.

150.—7 yrs. 3 mos. Grave 4 ft., moist, sand and clay. Premature birth.
No cadaver found in coffin, nothing to indicate that it had ever been placed therein. Clothes nicely folded in bottom of coffin. A most thorough search revealed but the following:

Thysanura, undetermined.
Coleoptera, Staphylinidæ, *Eleusis pallida* Lec., 1 specimen.
" Larvæ, undetermined.
Diptera, Phoridæ, puparium.

Note 3. Numbers 101–104, 118, 129, 133, 134, 135, 138, 140, 141 graves prepared as explained in note 2, page 217.

Note 4. The undetermined Coleopterous larvæ mentioned in the above lists belong, according to Mr. Schwarz, to but three species: *Actobius umbripennis* Lec., *Eleusis pallida* Lec. and *Rhizophagus scalpturatus* Mann. Owing to the illness of Mr. Schwarz, the determinations could not be specified in each case.

Grouped and arranged in systematic order, the fauna of the one hundred and fifty disinterments studied, as thus far determined, stands as follows:

GASTROPODA.

Helicodiscus lineatus Say. *Zonitoides minusculus* Binn.
Zonitoides arboreus Say. *Vitrea electrina* Gould.

Vermes, undetermined.

CRUSTACEA.

Armadillidium vulgare Ltr., many undetermined.

ARACHNIDA.

Pseudoscorpiones, *Chelanops tristis* Bks.

ARANEIDA.

Agalena, sp. *Lepthyphantes*, sp.
A. nævia Htz. *Lophocarenum*, sp.

Argiope, sp.
Bathyphantes, sp. n.
Cicurina arcuata Keys.
Cicurina creber Bks.
Lycosa, sp.
Theridium tepidariorum Koch.
Theridion subterranea Bks., sp. n.
Erigone albescens Bks., sp. n.

ACARINA.

Gamasidæ, *Gamasus*, sp.
Holostaspis, sp.
Hypoaspis, sp.
Iphis, sp.
Uropoda, sp.
Uropoda depressa Bks., sp. n.
Tyroglyphidæ, *Tyroglyphus*, sp. *Hypopus*, sp.
Oribatidæ, *Hoplophora*, sp. (*Tritia*).

MYRIAPODA.

Isobates (*I. minutus* Brandt?).
Iulus, sp.
Lithobius, sp.
Striaria, sp.
Scolopocryptops sexspinosa Say.

THYSANURA.

Japyx, sp. (*J. subterranea* Packard?).
Lepidocyrtus, sp.
Entomobrya, sp.
Podura, sp.
Many undetermined.

PSEUDONEUROPTERA.

Psocidæ, undetermined. *Termes flavipes* Kollar.

HOMOPTERA.

Coccidæ, *Ripersia*, sp.

COLEOPTERA.

Carabidæ, *Schizogenius amphibius* Hald. *Dicælus ovalis* Lec.
" *Harpalus faunus* Say.
Pselaphidæ, *Batrisus ferox* Lec. *Batrisus globosus* Lec.
Staphylinidæ, *Atheta*, sp.
Homalota, sp.
Staphylinus cinnamopterus Grav.
Philonthus, sp.
Actobius umbripennis Lec.
Actobius pæderoides Lec.
Lathrobium simile Lec.
Pæderus littorarius Grav.
Eleusis pallida Lec.
Trichopterygidæ, *Trichopteryx haldemanni* Lec.
Nitidulidæ, *Rhizophagus scalpturatus* Mann.
Trogositidæ, *Tenebrioides laticollis* Horn.
Elateridæ, *Monocrepidius bellus* Say.
Scarabæidæ, *Lachnosterna*, sp.
Curculionidæ, *Sphenophorus*, sp.

DIPTERA.

Mycetophilidæ, *Sciara*, sp.
Stratiomyidæ (larva).
Phoridæ (puparia), *Phora clavata* Loew ; *Conicera*, sp.
Muscidæ, *Compsomyia macellaria* Fabr.; *Lucilia cæsar* Linn.
Anthomyidæ, *Homalomyia*, sp.; *Ophyra leucostoma* Wied.
Sepsidæ, *Piophila casei* Linn.
Drosophilidæ, *Drosophila ampelophila* Loew.
Borboridæ, *Limosina*, sp.

HYMENOPTERA.

Formicidæ, *Brachymyrmex heeri* Forel.; *Camponotus melleus* Say.
" *Lasius americanus* Emery ; *Lasius flavus* DeGeer.
Poneridæ, *Ponera contracta* Latr.
Myrmicidæ, *Myrmicina latreillii* André.
Monomorium minutum Mayer.
Cremastogaster lineolata Say.
Aphenogaster, sp.

This list includes the names of a few species found, not in the one hundred and fifty human disinterments studied, but in the experimental observations, viz.: The undetermined Psocid, the Dipteron *Sciara* sp., and the Coleopteron *Trichopteryx haldemanni* Lec. were found in the empty boxes, buried for experimental purposes; while the Myriapod *Lithobius* sp., and the Diptera *Conicera* sp., *Phora clavata* Loew, and *Ophyra leucostoma* Wied., were found on dog cadavers, as noted elsewhere.

During the summer of 1896 the cadavers of a number of dogs, which had been examined in the laboratory for parasites, were tightly nailed up, each in a wooden box, and buried in a neighboring plot at a depth of two feet. Two of these, examined after two months, showed only the following Diptera: Phoridæ, *Phora clavata* Loew. Muscidæ, *Lucilia cæsar* Linn. Anthomyidæ, *Ophyra leucostoma* Wied. Of these, I have found only the Muscid on human cadavers, in four instances: (*a*) The living larvæ were found on the cadaver of a drowned negro after an exposure of three days and bred to the adult stage (No. 149). (*b*) The puparia were found on a cadaver (No. 2) which had been buried for two years and eleven months; and (*c*) puparia were likewise found on two cadavers (Nos. 11 and

14) which had been buried four years and one month. On the dog cadaver, buried two months, was found a fragment of one adult fly. This fly Mégnin puts in his second "squad," which arrives on cadavers a few hours after death. The Phorid was found in great numbers in the adult stage, busily feeding upon the contents of the box, which emitted a very pungent ammoniacal odor.

The Anthomyid was taken in the larval stage and bred in great quantities, in the laboratory, even unto the third and fourth generations. Notes of these breeding experiments were presented to the Entomological Society of Washington and will appear in the forthcoming issue of its Proceedings. Suffice it to say that, contrary to what has generally been known of the *Ophyra leucostoma* Wied., it seemed to thrive better upon decaying animal than upon vegetable matter. Mégnin places this fly in his fifth "squad," which he has found on human cadavers buried about two years. It is interesting to note just here that Schöyen found another species of this same genus, *Ophyra anthrax* Meig., in one of the cemeteries of Kristiania, in graves which had been dug but two months before, just the period of interment of the dogs in question. Schiner mentions *O. anthrax* as more rare than *O. leucostoma* still, in certain places very common; he found it in great numbers on the body of a dead horse in Kloster-neuberg.

On dogs buried for three months, this same Anthomyid, *O. leucostoma*, was found together with an undetermined Thysanuron and three Acarids of the Gamasid family: *Uropoda* sp., *Gamasus* sp. and *Hypoaspis* sp. The mites belong to Mégnin's sixth "squad," found on exposed human cadavers after two or three years. *Uropoda* I have found on twenty-one human cadavers, interred for periods varying from three years and six months to eleven years and seven months; *Hypoaspis*, on a human cadaver buried twenty-eight years; *Gamasus* on another, buried thirty-eight years and four months. While belonging to the same genus, it must be noted that the species of Gamasidæ found on dog cadavers are not identical with those found upon human cadavers.

On dogs buried for four months the principal find was the Phorid, *Conicera* sp., which was likewise bred in the laboratory through several generations. This fly is of special interest, because it was probably the first in America recorded by an accurate observer as having been found on a disinterred human cadaver; it will again be referred to later on.

On dogs buried for five months were found *Conicera* sp., adult flies and larvæ, together with *Uropoda* sp., identical with that found on dogs after three months' interment, but differing from that found on human cadavers; and, finally, an Elaterid beetle, *Monocrepidius bellus* Say, identical with that found on human cadavers after three years and two months' interment.

At this point the experimental work with dog cadavers ceased; first because there was such abundant material from the cemetery, and, secondly, because, according to Dr. Wyatt Johnston's experience, the results would be apt to be more confusing than helpful. Writing of his own observation in this line, Dr. Johnston said: "We were especially struck with the circumstance that Coleoptera which attack the bodies of animals early, *i. e.*, in a few days, will not attack human bodies unless these have been exposed some months. For this reason we avoided control experiments with dead animals and dead meat, as unreliable and misleading."

One other line of experimental investigation proved interesting and suggestive, though it was pursued in but two cases. At the suggestion of Mr. E. A. Schwarz, we buried in a cemetery, at a depth of three feet, two empty boxes which had been thoroughly cleaned and then closed with a well fitting cover securely nailed on. As it happened, we were enabled to place each of these boxes in a lot adjoining one in which an interment had recently been made, thus approximating, as nearly as might be, the conditions of an actual interment. After two months one of the boxes was taken up and found to contain a young Araneid, *Agalena nævia* Htz., several young Acarids of the Gamasid family, many Podurids (Thysanura), an undetermined Psocid, one small beetle, *Trichopteryx haldemani* Lec., and three Mycetophilid flies, *Sciara* sp. The second box, which was buried for a little over three months, was not quite so prolific, containing only one Araneid, *Theridium tepidariorum* Koch, and a few Podurids and *Lepidocyrtus* sp. (Thysanura). These small insects were no doubt feeding upon the delicate black fungus with which the boxes had become lined.

It is highly probable that further experiments in this line might be productive of interesting results. In the last case noted in the above list (No. 150) an empty (?) coffin, exhumed after seven years and three months, contained, among other things, the same beetle, *Eleusis pallida* Lec., which was found in such great numbers and under such

varying conditions in fifty-six of the one hundred and fifty observations and after periods of interment ranging from one year and eleven months to eleven years and two months. The cemetery records show that this particular coffin was supposed to contain the product of a "Premature Birth," but it seems highly propable that the coffin was sent to the cemetery, minus the cadaver, and that the latter now adorns some one's embryologic collection.

In 1890 Mr. Webster published an interesting find of *Conicera* sp., on a two-year cadaver, in the stomach of which chemic analysis showed one and one-half grains of arsenic. Commenting on this case, Mr. Webster writes: "That the larvæ of these flies might subsist upon the flesh of bodies killed by arsenic is by no means surprising, as they are, doubtless, very tenacious of life. * * * That adults or larvæ could have made their way to the body through box and coffin, after burial, seems incredible; while that with the temperature but little above the freezing point flies should have been attracted to the corpse, while the latter was awaiting burial, and either deposited their eggs upon it before burial or have been conveyed within the coffin to the grave and there begun reproduction appears at first thought almost equally impossible."

Here, then, are raised the questions upon the answers to which rest the importance and practical value of all these observations. How, when and during what periods do these insects attack the human cadaver? Mégnin's answers seem to have been accepted by the French courts, and decisions rendered, sentences imposed in accordance therewith. His work has been abstracted in a large number of journals, and in several different languages; everywhere it is labelled "Important—if true." Dominique writes a conservative review, complimenting Mégnin upon his work, at the same time suggesting that the science of an entomologic chronology of cadaveric history must, of necessity, be a slow growth. Here and there, however, there have been more or less vigorous protests. It is significant that these protests and warnings have come largely from the entomologists, men whose sole specialty is the study of the characters and life habits of these insects. True, when we attempt to look up the life-history of any given insect, especially one not important from an economic standpoint, we are amazed at the paucity of data, even with regard to our most common species. Among those who have made the life habits of beetles a special study, is Major L. von Heyden, who denies Mégnin's assertion

that the Nitidulid beetle, *Rhizophagus*, is attracted by the odor of the corpse, and declares that this beetle never feeds upon cadavers, but that it enters the grave as a parasite of the larva of another beetle (Scolytid) which infests the wood of which coffins are made. In spite of this high authority, I have found, in a number of cases the American cousins of this beetle feeding, beyond the peradventure of a doubt, upon the decomposing soft tissues and in the cancellated bone of the human cadaver.

Another item, about which we have yet much to learn, is with regard to the seasonal activity of a number of flies. Mégnin states, and he is confirmed by Webster's and by own experience, that the Phoridæ have been found on bodies interred in winter as well as in summer. But his conclusion, that the presence of Muscidæ indicates that the body in question was interred in summer and not in winter; and Johnston's and Villeneuve's conclusion, that the absence of Dipterous remains points to interment in winter and not in summer, have been too hastily drawn, if the study of but one hundred and fifty disinterments in Washington afford any criterion by which to judge. For, in ten of the one hundred and fifty cases, I have found the remains of a number of flies (Stratiomyid, Muscid, Sepsid and Borborid) on cadavers interred in December, January and February.

Two important facts must be noted just here: On the one hand, I have found, on looking up the recorded temperatures for several days preceding death and following burial, a degree of cold wholly incompatible with insect activity above ground; on the other hand, we not infrequently have in Washington, even in mid-winter, several successive days of sufficient warmth to start up the incubators of the omnipresent fly. That the presence of certain insects on a cadaver may indicate the exposure of that cadaver to a temperature favorable to the functional activity of these insects, is a conclusion wholly legitimate, and not without entomologic interest. Can it have any Medico-legal weight? To go before a Court of Law and to swear that because a Muscid was found upon a disinterred human cadaver, that cadaver *might* have been interred in June, but *could not* have been interred in January, would be to fly in the face of facts and to assert a proposition controverted by practical experience. Be it remembered that these remarks apply only to interred human cadavers, only to those interred in the vicinity of Washington, and only from the limited view of this field obtained from one hundred and fifty observations.

I am thoroughly convinced that we can not, as yet, make any broad, universally applicable generalizations on this subject. The field is far too broad, the important and modifying factors are far too numerous and conflicting, the conditions vary far too widely to be thus comprehended in any concise, unqualified formula. The only conclusion I can reach, as the result of my studies thus far, is that it is not safe to draw any conclusion at all. The vital point upon which the whole of Mégnin's theory of the fauna of exposed cadavers turns, is that the various insects appear in distinct "squads," at definite and specified periods of cadaveric decomposition, and that they succeed each other in regular order. That this proposition does not in any particular apply to the observations here noted is most evident from the following brief resumé of the work, taking only the more important mites, beetles and flies:

Acarina, 8 species found in 30 cases, interred from 3 years and 2 months to 71 years. Coleoptera, Pselaphidæ, 2 species found in 3 cases, interred from 16 years and 5 months to 28 years. Staphylinidæ, *Homalota*, found in 4 cases, interred from 1 year and 11 months to 10 years; *Staphylinus* found in 1 case, interred 15 years and 5 months; *Philonthus* found in one case, interred 5 years and 4 months; *Actobius* found in 22 cases, interred from 3 years and 2 months to 10 years; *Lathrobium* found in 3 cases, interred from 4 years and 4 months to 9 years and 9 months; *Pæderus* found in 1 case, interred 3 years and 2 months; *Eleusis* found in 56 cases, interred from 1 year and 11 months to 11 years and 2 months. Nitidulidæ, *Rhizophagus* found in 10 cases, interred from 1 year and 11 months to 28 years. Diptera, Phoridæ, puparia found in 43 cases, interred from 3 years and 2 months to 38 years; Muscidæ, 2 species found in 5 cases, interred from 3 days to 4 years and 1 month; Anthomyidæ, *Homalomyia* found in one case, interred 2 years and 11 months; Sepsidæ, *Piophila* found in 13 cases, interred from 3 years and 2 months to 10 years and 3 months.

Since the completion of this paper, the writer has received a reprint of Johnston & Villeneuve's paper, "On the Medico-Legal Application of Entomology," which was "read before the Canadian Medical Association, Montreal, August, 1896," and published in the *Montreal Medical Journal*, August, 1897. These authors assert that "one may now judge from the animal fauna met with in a dead body how long it has been exposed." But they add: "The chief danger to be feared from Mégnin's imitators is that they might tend to indulge

in guesses having no very solid basis and to apply rules to countries and climates where they were inapplicable." They conclude that, "it appears certain that observations and experiments upon exposed human bodies should be made in the particular locality before the present entomological data can be directly applied to legal medicine. * * * The time limits apparently require modification for the particular locality."

It should be remembered that the experience of Johnston & Villeneuve has been almost entirely with exposed cadavers—as distinguished from the present observations on interred cadavers. They print an interesting table, which is hereto appended.

FAUNA OF DEAD BODIES EXPOSED TO THE AIR.*

(COMPILED FROM MÉGNIN.)

	Physical Conditions.	Minimum time.	Forms met with.
First Period	Bodies fresh	First three months.	(D) *Musca.** *Cyrtoneura.** *Calliphora.**
Second Period	Decomposition commenced		(D) *Lucilia.** *Sarcophaga.**
Third Period	Fatty acids	3 months to 6 months.	(C) *Dermestes.** (L) *Aglossa.* (D) *Piophila.** *Anthomyia.* (C) *Necrobia* (*Corynètes*).
Fourth Period	Caseous products		
Fifth Period	Ammoniacal fermentation, black liquefaction	4 months to 8 months.	(D) *Thyreophora.* *Ophyra.** *Lonchea*, *Phora.* (C) *Necrophorus.* *Silpha.** *Hister.** *Saprinus.**
Sixth Period	Desiccation	6 months to 12 months.	(A) *Uropoda.* *Trachynotus.* *Tyroglyphus.** *Glyciphagus.* *Serrator.*
Seventh Period	" extreme	1 year to 3 years.	(L) *Aglossa.* *Tineola.* (C) *Attagenus.* *Anthrenus.*
Eighth Period	Debris	Over 3 years.	(C) *Tenebrio.* *Ptinus.*

FAUNA OF BURIED BODIES.

Before Burial	(D) *Calliphora,* Cyrtoneura.*
After Burial	(D) *Ophyra,* Phora.*
(The genera marked * in the table are those met with by ourselves.)	(C) *Philonthus,* Rhizophagus.*
	(T) *Achorutes, Templetonia.*

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EXPLANATION OF TABLES.

TABLE I. Showing entire "find" on human cadavers buried for varying periods. In the first column are given the serial numbers, with numbers referring to notes on individual observations. Next is indicated the duration of interment, expressed in years and months; then the month in which interment was made and that in which the body was disinterred. Then follow the depth of the grave and character of soil—"s" = sandy, "c" = clay, and "sc" = sand and clay mixed. The degree of moisture, noted in the grave at the time of disinterment, is indicated as follows: 1 = dry, 2 = moist, 3 = wet, 4 = coffin submerged. The figures in the body of the table indicate the number of the specimen or specimens, in the Stiles-Motter collection of grave-fauna, to be deposited in the U. S. National Museum. Some of these specimens, more particularly of the lower forms, have not as yet been fully determined.

* (D) Diptera, (C) Coleoptera, (L) Lepidoptera, (A) Acari, (T) Thysanura.

d" on Human Cadavers buried for varying periods.

INSECTA.																										
		Coleoptera.																	Diptera.					Hymenoptera		
Pseudoneuroptera.	Undetermined.	Carabidæ.	Pselaphidæ.	Staphylinidæ.	Homalota.	Staphylinus.	Philonthus.	Actobius.	Lathrobium.	Pæderus.	Eleusis.	Nitidulidæ.	Trogositidæ.	Elateridæ.	Scarabæidæ.	Curculionidæ.	Larvæ (Genus.)?	Stratiomyidæ.	Phoridæ.	Muscidæ.	Anthomyidæ.	Sepsidæ.	Borboridæ.	Formicidæ.	Poneridæ.	Myrmicidæ.
					P						P	P														
																				180	181					
																			5							
								170		167	170			168				L 169	174			171	173			
																			19							
																				254						
											281								280							
											289								291							
								296			297											300				
											302						303									
								277			278									275		276				
											283															
																			286							284
																			[illegible]	[illegible]		[illegible]				

TABLE 2, groups the mites, beetles and flies, which have been held to be especially significant as time-indicators, and shows that the same species have been found after widely varying periods of interment. This is in direct contrast with the "principle" hitherto deduced, from observations on exposed cadavers, "that the products formed at different epochs in the progress of decomposition attract certain forms and repel others." A principle which Mégnin reiterates in a recent "Note sur une collection d'Insectes des cadavres interessants a connaitre au point de vue Medico-legal, offerte au Museum."

NOTES ON CERTAIN SOUTH AMERICAN COCHLIDIIDÆ AND ALLIED FAMILIES.

BY HARRISON G. DYAR.

At my request Mr. W. Schaus kindly brought me a number of moths from his collection for examination. Many of them are his types of species recently described and the rest have been carefully determined by him. The following notes are based on this material. It includes the groups closely allied to the Cochlidiidæ as well as that family itself, and one species of Ptilodontidæ, which was improperly described as a Cochlidian.

Family DALCERIDÆ.

Synopsis of Genera.

Fore wings without accessory cell; antennæ with prominent scale tuft at tip.
- Vein 6 arising above discal vein; vein 11 from cell.................. **Dalcera**
- Vein 6 arising below discal vein; vein 11 stalked with 9 and 10.... **Dalcerina**

Fore wings with accessory cell; antennæ without scale tuft.
- Veins 9 and 10 long stalked, but distinct .... **Acraga**
- Veins 9 and 10 coincident, 9 absent or invisible.
  - Hind wings ovate, rounded.......... .... **Dalcerides**
  - Hind wings trigonate, inner margins long................. **Epipinconia**

Genus **Dalcera** *H.-S.*

1855—*Dalcera* HERRICH-SCHÄFFER, Ausser. Schmett. I. 7.

Type, *abrasa* H.-S.: also *fumata* Schaus, both before me. Möschler has given the generic characters. Others species listed are *obscura* Schs., *alba* Druce, *laxata* Druce, *ampla* Druce and *leberna* Druce, but I have not examined them.

Genus **Dalcerina**, nov.

Antennæ short, bipectinate, a tuft of scales at tip above; head prominent, eyes large; palpi porrect, slender, exceeding the front by half their length, not reaching vertex; third joint minute. Legs slender, hind tibiæ with end spurs only. Wings full, rounded; fore wing costa straight, rounded at apex; vein 1, furcate at base, without branch; 1 c present; 2 at middle of cell; 4 and 5 short stalked; cell closed by the short, wide angled furcation of discal vein; 6 midway between 5 and discal vein; 7 and 8 long stalked below apex of cell; 9 and 10 very long stalked as in *Dalcera*, but 11 also stalked with 9 and 10 for some distance; 12 from base; retinaculum a long fold. Hind wings with three internal veins; vein 2 from the middle of cell: 3 and 4 arising close together; 5 from the lower part of cross vein; discal vein as on fore wing; 6 and 7 very remote, running parallel; 8 very close to 7 to end of cell, but free or with a trace only of a cross bar toward base where the vein is rounded toward costa. Frenulum long.

Type *tijucana* Schaus (Proc. Zool. Soc. Lond., 1892, 322). Mr. Schaus' type is before me, and looks, superficially, like a variety of *Dalcera fumata*.

Genus **Acraga** *Walk.*

1855—*Acraga* WALKER, Cat. Brit. Mus. Lep. Het. IV, 807.

1882—*Pinconia* MOORE, Proc. Lit. Phil. Soc. Liverp. XXXVI, 364.

Venatation as in *Dalcera* (*vide* Möschler, Verh. Zool. Bot. Ges. Wien, XXVII, 673), but accessory cell present; veins 7–8 and 9–10 on stalks from accessory cell; 11 from the top of accessory cell.

Type *ciliata* Walker; also *moorei* Dyar (|| *ochracea* Moore), *ochracea* Walk. and *coa* Schaus. Also *melinda* Druce, unknown to me. I am indebted to Sir G. F. Hampson for information about Walker's type in the British Museum.

Genus **Dalcerides** *N. & D.*

1893—*Dalcerides* NEUMŒGEN and DYAR, Can. Ent. XXV, 121.

Close to *Acraga*, but the stalk of veins 9 and 10 reaches tip of wing.

Type *ingenita* Hy. Edw.; also *mesoa* Druce, the latter from Mr. Schaus' collection.

Genus **Epipinconia**, nov.

Antennæ short, bipectinate; eyes large; palpi slender, porrect, reaching half their length beyond the front; legs slender, hind tibiæ without spurs. Fore wing triangular, costa straight; vein 10 shortly stalked on the stalk of 7 and 8, 9 coincident (absent), 11 at base of accessory cell, all as in *Dalcerides*. Hind wings trigonate; inner margin long, anal angle sharply rounded, as also apex, the outer margin nearly straight; veins 2 to 5, somewhat equally spaced, 3 and 4 nearest; 6 above the end of discal vein, remote from and parallel to 7; 8 close to subcostal to end of cell, then divergent. Thinly scaled, bronzy, glistening species.

Type *flava* Walker (Cat. Brit. Mus., V, 1107); also *citrina* Schaus are before me.

Family MEGALOPYGIDÆ.

Genus **Aidos** *Hübner*.

1818—*Aidos* HÜBNER, Verz. Bek. Schmett. 191.
1895—*Brachycodion* DYAR, Can. Ent. XXVII, 244.

This has the venation of *amanda*, but veins 8 and 9 form a rounded rather than an angular furcation and 10 and 11 are very shortly stalked together. On hind wings veins 3 and 4 are shortly stalked; 6 and 7 separate and parallel; 8 free to base.

Type *amanda* Stoll; also *yamouna* Dogn. (*Euclea yamouna* Dognin, Le Nat., XIII, 126) from Mr. Schaus' collection.

Genus **Brachycodilla**, nov.

Antennæ lengthily pectinated on basal half, terminal half simple (serrate), the regions sharply marked; head sunken, palpi short, porrect, just reaching frontal tuft. Robust, vestiture suberect; legs rather long, posterior tibiæ with terminal spurs only. Venation essentially as in *Aidos* (*vide* Can. Ent., XXVII, 244), but vein 8 of hind wings is joined to subcostal by a strong bar at the end of the cell.

Type *castrensis* Schaus (Journ. N. Y. Ent. Soc., IV, 56); also *B. carmen* Schaus (*Talima carmen* Sch.) and *B. admirabilis* Schaus (*Perola admirabilis* Sch.) are before me, the latter retained in my collection by the kindness of Mr. Schaus.

Genus **Cyclara** *Schaus*.

1896—*Cyclara* SCHAUS, Journ. N. Y. Ent. Soc. IV, 57.

Besides the characters given by Mr. Schaus, vein 1 of fore wings has a long branch on the lower side (characteristic of the Megalopygidæ); vein 6 arises above the concavity of the cell; cell broad; stalk of veins 7 and 8 drooping from that bearing 9; hind wings with veins 6 and 7 remote and parallel; 8 touching the cell except at base and extreme apex. Antennæ much shorter than half of fore wing, but not disproportionately short as the body is slender, pectinated to the tip; eyes large; palpi very short, almost rudimentary, not reaching the front; legs slender, rather long, hind tibiæ without spurs. A fragile insect, with proportionately large rounded wings.

Type *ovata* Schaus. Mr. Schaus' type is before me.

Family COCHLIDIIDÆ.

A. Male antennæ bipectinate on basal portion, the terminal half simple.
a. Discal vein long forked, the limbs forming an angle of less than 90°.

Genus **Sibine** *H.-S.*

1855—*Sibine* HERRICH-SCHAEFFER, Ausser. Schmett. I, 7.
1855—‖*Nyssia* WALKER, Cat. Brit. Mus. V, 1132.

1860—*Empretia* CLEMENS, Proc. Acad. Nat. Sci. Phil. XII, 158.
1866—*Eupalia* WALKER, Cat. Brit. Mus. XXXV, 1927.
1878—‖*Streblota* BERG, Ann. Soc. Argent. V, 177.
1878—*Neomiresa* BUTLER, Trans. Ent. Soc. Lond, 74.

Type *nesea* Stoll. Mr. Schaus has loaned me specimens labelled *modesta* Cr., *plora* Schaus, *extensa* Schaus, and *trimacula* Stoll. I should regard the first three as the same species in most genera, but here the larvæ should be known for certainty.

Genus **Episibine**, nov.

Male antennæ bipectinated on basal third, the tip simple; palpi not reaching beyond the frontal hairs; fore wings with costa straight, inner margin sinuate, veins 2, and 3 separate, 8 and 9 stalked, 11 straight; fork of discal vein long and closed by a cross-vein; hind wings triangular, veins 6 and 7 separate at base, but divergent; 8 anastomosing at base; hind tibiæ without perceptible spurs.

Type *auromacula* Schaus (Journ. N. Y. Ent. Soc., IV, 56). Mr. Schaus' type is before me. This is a specialization of the ordinary *Sibine* form, the hind wings shaped as in the male of *Phobetron*.

Genus **Euclea** *Hübner*.

1822—*Euclea* HÜBNER, Verz. Bek. Schmett. 149.
1854—‖*Neæra* HERRICH-SCHÄFFER, Samml. Ausser. Schmett. I, fig. 176.
1859—*Parasa* MOORE, Cat. Lep. E. I. Co. 413.
1860—*Nochelia* CLEMENS, Proc. Acad. Nat. Sci. Phil. XII, 159.
1864—*Callochlora* PACKARD, Proc. Ent. Soc. Phil. III, 339.

Type *cippus* Cramer.

§ 1. Fore wings with vein 10 from end of cell (*Parasa*).

E. imitata *Druce* ♂, kindly added to my collection by Mr. Schaus.

E. cebrenis *Sch.* ♂ ♀, (♀ *Trabala cebrenis*). The female has been described by Mr. Schaus and figured by H. Druce (Biol. Cent.-Am., Lep. Het., II, pl. 87, fig. 11). The male associated with it is *E. lysia* Druce (Biol. Cent.-Am., II, 439) without any green on the fore wings. Mr. Schaus stated to me that he had a reason for this unexpected association, but he could not then recall what it was.

E. minima *Schaus.*

♂, Identical with *chloris* H.-S., except that the green band is of about half the width and does not touch the base of the wing. The moth is a little smaller than is usual in *chloris*.

E. viridogrisea, sp. nov.

Vertex of head and thorax above bright green; abdomen, thorax below and legs dark slate gray; wings uniformly dark slate gray, the veins not lined; on fore-

wings a rather narrow bright green band crosses the wing at about the middle and runs along internal margin to base; it is edged on both sides narrowly with light red brown; width of band about one-fourth the length of wing, a little narrower centrally from the brown outer border becoming broader at that point; the terminal space is slightly grizzled by pale scales. Expanse, 32 mm.

Type, one female in the collection of Mr. Schaus, who says that this is the "*chloris*" of the Biologia Centrali-Americana.

§ 2. Fore wing with vein 10 stalked (*Euclea*).

E. diversa *Druce*. (*Semyra diversa* D.)

The figure in the Biologia is poor. The silvery line near internal margin should be a slender zigzag, produced a little along vein 2 and narrowly along vein 1 to base. The ordinary green of the genus is here replaced by dark brown. The pretty species seems to suggest some affinity with *Monoleuca* in markings.

E. copac *Schaus*. (*Neomiresa copac* Sch.)

A pretty dark gray species, with ovate, rounded wings.

Genus **Metraga** *Walk.*

1855—*Metraga* WALKER, Cat. Brit. Mus. V, 1129.

Type *perplexa* Walk. This species is before me. The genus seems a good one, close to *Euclea*, but differing in the large palpi, which reach nearly to the vertex of head, and in the convex costa; vein 11 is distinctly curved toward vein 12 at base; the discal vein is long forked and the cell closed by a cross-vein.

Genus **Miresa** *Walk.*

1855—*Miresa* WALKER, Cat. Brit. Mus. V, 1123.

Type *albipuncta* H.-S. In this genus the discal vein is long-forked, the limbs connected by a cross-vein outwardly; but often the upper limb is weak, so that the cross-vein practically replaces it, and the deceptive appearance of Hampson's figure is produced (Moths of India, I, 386).

M. argentea *Druce*. (*Eupalia argentea* D.)

The upper limb of the discal fork is quite strong and distinct; the palpi are a little longer than normal, just exceeding the front, and the pectinations of antennæ are not sharply marked off from the simple portion, the serrations running to apex. This is a generalized species in all these characters, possibly separable generically from *Miresa* (it would fall in *Asteria* Feld).

M. argentata *Walk*. (*Nyssia argentata* Walk.)

A true *Miresa*, close to the Indian species *bracteata* Butl., *argentifera* Walk., and *nivaha* Moore. The upper limb of discal fork is nearly absent, just traceable as a slight fold.

Genus **Idonauton** *Swinhoe.*

1892— *Idonauton* HAMPSON, Moths of India, I, 391.

Type *apicale* Walker.

I. straminea *Schaus.* (*Semyra straminea* Sch.)

This may be referred here provisionally. I have no male, hence do not like to propose a new genus. The palpi agree with *Idonauton*; head sunken, front not tufted; hind legs with terminal spurs only; venation agreeing with Hampson's figure, vein 10 from end of cell, but discal vein forked and closed by a cross vein.

b. Discal vein short-forked, the limbs forming an angle of 90° or more.

Genus **Talima** *Walk.*

1855—*Talima* WALKER, Cat. Brit. Mus. V, 1120.

Type *postica* Walker. The type species is before me. Venation of *Parasa*, except for the short forked discal vein, of which the two limbs close the cell, widely divergent, looking like a single vein meeting the end of cell. Vein 11 slightly curved at base. The palpi are upturned nearly to vertex; hind tibiæ with end spurs only. A thinly scaled, simply marked form, more generalized than the preceding.

Genus **Protalima,** nov.

Closely allied to *Talima*, but the palpi are short, not exceeding the frontal tuft, and the inner margin of hind wings is rounded, less long drawn out than in *Talima*. This would fall in *Miresa*, except for the structure of the discal vein. The superficial appearance, however, is like *Talima*, and is here really the best guide to affinity

Type *sulla* Schaus (*Nyssia sulla* Sch., Proc. Zool. Soc. Lond., 1892, 324).

B. Male antennæ bipectinated to the tip; fork and discal vein short and open.

a. Palpi long, reaching near or above vertex.

* Veins 2 and 3 of fore wings separate.

Genus **Vipsania** *Druce.*

1887—*Vipsania* DRUCE, Biol. Cent.-Am. Lep. Het. I, 217.

Palpi as in *Hyphorma*; fore wings with veins 7–9 stalked; fork of discal vein short and open, but a peculiar deceptive fold lies from the middle of the vein to origin of vein 6; hind wing like *Hyphorma*, but discal vein not forked; veins 6 and 7 from a point. Hind legs broken; but I learn from Sir G. F. Hampson that Druce's

type has two pair of spurs. The male is needed to place this genus finally; compare section C.

Type *anticlea* Druce ♀. Only the female is known and Mr. Schaus' specimen is one of this sex. Consequently the male antennæ are unknown.

Genus **Semyra** *Walker.*

1855—*Semyra* WALKER, Cat. Brit. Mus. V, 1130.

1878—*Eulimacodes* MÖSCHLER, Verh. Zool.-Bot. Ges. XXVII, 672.

Type *coarctata* Walk. The type species is before me; also Mr. Schaus' type specimen of *Eulimacodes möschleri*, which is simply the female of *coarctata* Walk. *S. distincta* Möschl., with the same structure and pattern, but larger and *S. bella* H.-S. are also before me. *S. cardia* Schaus begins to depart a little from the generic type. The palpi are a little shorter, not quite attaining the vertex, about as in *Prosternidia* Saalm., with which this species might be confounded in a synoptic table, though the markings are as in *Semyra*.

Genus **Prosternidia** *Saalm.*

1884—*Prosternidia* SAALMÜLLER, Lep. Madagascar, I, 208.

Type *metallica* Saalm. I have not seen this type, but from the characters given, place in the genus provisionally *P. elæa* Druce (*Perola elæa* D.), which is before me.

* * Veins 2 and 3 of fore wings stalked.

Genus **Amydona** *Walk.*

1855—*Amydona* WALKER, Cat. Brit. Mus. V, 1110.

Type *subpunctata* Walk. Mr. Schaus has kindly given me *Perola dora* Druce, which he thinks is the same as *subpunctata* Walk. The forks of discal vein form a right angle, or a trifle less; open. Congeneric are *A. sucia* Schaus (*Perola sucia* Sch.) and *A. platona* Schaus.

Amydona sericea *Schaus.*

This does not belong here, but I cannot place it, as the hind legs are gone. It is a curiously contradictory form, the male antennæ being distinctly pectinated to the tip, though decreasing rapidly on terminal half, while the fork of discal vein is long and closed by a cross-vein. The palpi are upturned above vertex, third joint long and slender; head rather prominent. Venation normal, vein 1 with many small veinlets toward the margin, but no distinct branch; veins 2 and 3 widely separate, 7 to 9 stalked, 11 oblique; hind wings with

6 and 7 from a point, 8 anastomosing near base. Mr. Schaus' type is before me. This doubtless represents a new genus.

b. Palpi moderate, reaching beyond frontal tuft.

* Veins 2 and 3 of fore wings separate.

Genus **Natada** *Walk.*

1855—*Natada* WALKER, Cat. Brit. Mus. V, 1108.

Type *rufescens* Walk. *Perola daona* Druce is before me. It belongs to this genus and seems specifically identical with *N. nasoni* of the United States.

Genus **Sisyrosea** *Grote.*

1876—*Sisyrosea* GROTE, Can. Ent. VIII, 112.

Type *textula* H.-S. *Amydona lucens* Walk. is before me. The legs are broken, but the other characters agree exactly. *Semyra diana* Druce is similarly mutilated, but otherwise falls here.

Genus **Thosea** *Walk.*

1855—*Thosea* WALKER, Cat. Brit. Mus. V, 1068.

Type *unifascia* Walk. *T. fusca* Druce is before me (*Trabala fusca* D.) and falls here, agreeing with the characters given in Hampson's "Moths of India."

* * Veins 2 and 3 of fore wings stalked.

Genus **Epiperola,** nov.

Male antennæ bipectinated to the tip; palpi upturned, slightly exceeding the front, third joint small but distinct; fore wings with costa straight, veins 2 and 3 stalked, 7 to 9 stalked, 11 straight; fork of discal vein short and open; hind wings with veins 6 and 7 from a point, 8 anastomosing near base; hind tibiæ with terminal spurs.

Type *drucei* Schaus. (Proc. Zool. Soc. Lond., 1892, 323.)

This differs from *Perola* in lacking the middle spurs of hind tibiæ and in length of palpi.

c. Palpi short, not exceeding frontal tuft.

* Veins 2 and 3 of fore wings stalked.

Genus **Perola** *Walk.*

1855—*Perola* WALKER, Cat. Brit. Mus. IV, 920.
1855—*Romosa* WALKER, Cat. Brit. Mus. V, 1114.
1855—*Camila* WALKER, Cat. Brit. Mus. V, 1126.

Type *murina* Walk. The type species is before me. Also *P. villosipes* Walk. (*Trabala villosipes* Walk.), *sericea* Möschl. (*Asbolia seri-*

cea Möschl.), *cicur* Sch., *druceoides* Dogn., *brumalis* Sch. and *rubens* Sch., all before me. I am indebted to Sir G. F. Hampson for the structural characters of the genera referred to the synonymy.

Genus **Paleophobetron,** nov.

Male antennæ bipectinated to the tip; palpi porrect, just reaching the front; fore wings with costa straight, veins 2 and 3 stalked, 11 straight, fork of discal vein broadly open without cross-vein; hind wings triangular, veins 6 and 7 stalked, 8 anastomosing at base; hind tibiæ with small terminal spurs.

Type *arcuata* Druce (Biol. Cent.-Am. Lep. Het., II, 444, pl. 88, fig. 9).

This differs from *Perola* in lacking the middle spurs of hind tibiæ and in wing shape.

C. Male antennæ simple.

a. Veins 6 and 7 of hind wings from a point or stalked.

Genus **Pseudovipsania,** nov.

Male antennæ simple; palpi porrect, three times as long as the head, third joint distinct, quadrate; fore wings with costa straight, veins 2 and 3 separate, 7 to 9 stalked, 11 very slightly curved toward 12 at base, fork of discal vein short and open; hind wing with veins 6 and 7 stalked, 8 anastomosing at base; hind tibiæ with terminal spurs, the legs weaker than the middle pair which are apparently abnormally strengthened.

Type *frigida* Schaus (Proc. Zool. Soc. Lond., 1892, 323).

Genus **Prolimacodes** *Schaus.*

1896—*Prolimacodes* SCHAUS, Journ. N. Y. Ent. Soc. IV, 56.

Type *triangulifera* Schaus. Mr. Schaus has given me a specimen of the typical species. The structure is as in the North American *scapha*, except that vein 10 of fore wings is from cell and 6 and 7 of hind wings from a point. It is a form a little more generalized than our species, but, I think, not generically distinct therefrom.

Family PTILODONTIDÆ.

Trabala truncata *Schaus.*

Belongs to this family (Melalophidæ). In the synoptic table it falls with *Harpyia*, but the tongue is imperceptible and the wings are shorter and more triangular. The palpi are scarcely curved, and exceed the front by half their length; third joint small. I do not yet know enough of the South American Ptilodontid genera to place this form.

THREE NEW SPECIES OF SESIIDÆ.

BY WILLIAM BEUTENMÜLLER.

Sesia tacoma, sp. nov.

Male: Head deep black, palpi yellow above and clothed with long black and yellow hair beneath. Collar narrowly yellow in front. Thorax deep black with a narrow yellow stripe on the patagiæ and a narrow, yellow, transverse mark at the posterior end. Abdomen deep black with a narrow yellow band at the end of the second, fourth and sixth segments. Anal tuft black, fan like and mixed with a little yellow beneath at the middle. Thorax beneath with a large yellow patch on each side. Femora black with loose scales; tibiæ banded with yellow; tarsi yellow. Anterior coxæ with a yellow line. Fore wings transparent, brown-black at margins and on the veins; space between median vein and inner margin orange-red, also orange-red between the veins on the outer part of wings and border of the cell. Transverse mark large, black and touched with orange-red on each side. Transparent part beyond this mark rounded; elongate and triangular in cell. Fringes brown. Hind wings wholly transparent and narrowly bordered with violet black; fringes brown. Antennæ black. Fore wings beneath largely orange-red except borders and the transverse mark which is much reduced. Hind wing like above, but with an orange line in outer border. Expanse, 19–21 mm.

Female: Head, thorax, legs and abdomen as in the male, but the abdomen is heavier with the bands somewhat broader. Palpi wholly yellow. Fore wings with the orange-red and heavier, giving them a red appearance with narrow black margins. Hind wings with a narrow red margin before the brown fringes. Underside almost entirely golden orange-red and narrowly bordered with brown-black outwardly and the fringes. Transverse mark red, sometimes with a black center. Hind wings beneath similar to the above. Abdomen beneath with three bands at end. Anal tuft black, a little yellow beneath. Expanse, 20–22 mm.

Habitat: 1 ♂, Big Horn Mts., Wyoming, July 11, 1896 (R. P. Currie), Type, U. S. National Museum; 3 ♂, 6 ♀, Mt. Ranier, 6,300 feet, Washington State, August, on *Veratrum viride* (C. V. Piper).

Sesia arizonæ, sp. nov.

Head brown black; collar canary yellow in front; palpi wholly canary yellow. Thorax brown-black with a narrow yellow line on the patagiæ. Abdomen blue black; first segment yellow and with a yellow band at the ends of the 3–7 segments, inclusive, those on the third, fifth and seventh segments twice as broad as the others. Anal tuft largely yellow, black at the sides and beneath. Thorax beneath with a large yellow patch on each side. Abdomen beneath with the bands repeated or only partly repeated. Femora blue-black; tibiæ banded with yellow, tarsi wholly yellow as are also the anterior coxæ. Fore wings violet brown, with the usual transparent spaces, wholly or partly filled with golden-orange and only slightly transparent beyond the golden-orange transverse mark, also streaked with this color between the

veins on the outer part of the wings. Hind wings transparent, fringes fuscous, narrowly orange at base. Underside of fore wings golden-orange with the veins on outer part violet. Hind wings beneath same as above. Antennæ black. Expanse, 22 mm.

1 ♀, Summit of Mt. Union, 9,000 feet, Arizona, July 3, 1887, flying about scrub oak (G. D. Hulst). Coll. Hy. Edwards.

1 ♀, Texas. Coll. U. S. Nat. Mus.

Pyrrhotænia coccinea, sp. nov.

Head black; palpi yellow, tip black; collar narrowly edged with white in front. Thorax and abdomen bronzy-black with a metallic reflection. Antennæ brown-black. Underside of thorax with a scarlet patch on each side. Legs metallic blue-black. Fore wings bright scarlet-red, outer border and a round spot at end of cell bronzy-brown. Hind wings brown. Underside of fore wings light orange, outer part brown, discal spot much reduced. Hind wings beneath same as above. Expanse, 12 mm.

1 ♀, Albuquerque, New Mexico. (Cockerell.) Type, Coll. U. S. Nat. Mus.

Very different from any of the hitherto known species. It may be at once recognized by the bright red fore wings with brown outer border and discal spot.

THE LIFE-HISTORIES OF THE NEW YORK SLUG CATERPILLARS.—XVII.

PLATE XI, FIGS. 1–12.

BY HARRISON G. DYAR, A.M., PH.D.

Heterogenea shurtleffii *Packard.*

1864—*Heterogenea shurtleffii* PACKARD, Proc. Ent. Soc. Phil. III, 346.
1882—*Heterogenea shurtleffii* GROTE, Check List. p. 18.
1891—*Heterogenea shurtleffii* and var. *cæsonia* SMITH, List Lep. p. 29.
1892—*Heterogenea shurtleffii* KIRBY, Cat. Lep. Het. I, 556.
1894—*Heterogenea cæsonia* ? NEUMOEGEN & DYAR, J. N. Y. Ent. Soc. II, 74.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space rather narrow and of uniform width, narrowing a little posteriorly, but scarcely so anteriorly; full, rounded, not concave. Sides obliquely concave; subventral space small, retracted. Ridges at first prominent, with large, low, distinct segmentary tubercles; later the subdorsal ridge indicated by the change in direction between

back and sides, lateral one projecting, smooth, neither ever spinose. Setæ of stage I, as in *Tortricidia pallida*, differing only in detail. Later the warts are represented by distinct short setæ which diminish nearly to obliteration during ontogeny. Depressed spaces well developed, fairly large, (1) to (8) present. Skin at first smooth, later covered with round, clear granules, each with a minute central spine and crown of four to eight around it, causing the skin to appear minutely furry. The granules appear well formed first on the ridges, later spreading more evenly over the body. The fur-like spines become smaller at each subsequent molt till in the last stage they are absent, leaving the granules perfectly smooth. Coloration green with yellow lines and a small red mark. There are six larval stages.

AFFINITIES, HABITS, ETC.*

Allied to *Tortricidia pallida* and *Heterogenea flexuosa*. Stage I is most like *flexuosa*, but the Y-shaped setæ are distinctly alternating, as in *pallida*, or more so, and there is a brown cervical shield. In stage II the setæ persist as in *pallida*, but the granulation is at once distinguished from either by the peculiar fur on the ridges, which passes less perfectly into the spaces. The ridges are prominent and distinc tlysegmentarily beaded as in neither of the allies. Later, owing to the diminution of the fur and the small size of the red mark, the larva resembles most *flexuosa*, and may be distinguished from some forms of that species only by the yellow collar. It is less strongly pigmented, a clearer, less yellowish-green, while the pattern of coloration is much less extended, though essentially the same as in both allies. The transverse yellow line on joint 3, or collar, is present in this species only. The depressed spaces are yellow, as in *flexuosa*.

The moths emerge somewhat later than those of the allied species, during the first weeks in July. The larvæ have the same habits and occur in the same situations as *flexuosa*, but show a more marked pref-

* The nearest ally of our *H. shurtleffi* will doubtless prove to be the European *H. cruciata*. The moths are strictly congeneric, whereas *H. flexuosa* and its variety *cæsonia* do not belong to *Heterogenea* or to *Lithacodes*, but properly to *Tortricidia*. *H. shurtleffi* has been very rare in collections, only the type being known for thirty-four years. Consequently it appeared to Mr. Neumœgen and myself that it might prove an aberrant form of *cæsonia*. However we overlooked two important structural characters, not having the type for examination; but this has recently been sent to me by Mr. Henshaw. It agrees with my bred specimens, of which a full account is presented herewith. The specimens are deposited in the U. S. National Museum.

erence for large trees. I have found them rarely in Van Courtlandt Park, New York, and in several places on Long Island, most numerously at South-haven and Speonk. Mr. Joutel has found them at Glendale, but on small trees, as he tells me. This species is distinctly a local one, and when once found, a number of larvæ can be secured. I have encountered a colony in the District of Columbia on some iron wood trees growing on the shores of Rock Creek and overhanging the water. The situation is such that any other of our Eucleids could not live there, as they would fall in the water and be drowned at pupating time.

The larval stages are passed with unusual rapidity. Mature larvæ are first seen early in August, and but few last into September. With the exception of *Kronæa minuta*, this is our smallest Eucleid larva.

CRITICISM OF PREVIOUS DESCRIPTIONS.

This larva has not been described, yet a specimen was seen by us before writing the synoptic table (Journ. N. Y. Ent. Soc., III, 146), and confused there with *Heterogenea flexuosa*.* Only the last five words of the diagnosis were written actually from a specimen of *flexuosa*; the other words apply to the species, although not indicating the best specific differences. A corrected synoptic table will be given at the end of these articles.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Very small; elliptical, flat, shining, slightly milky and iridescent. Reticulations obscure, linear, elongated and irregularly quadrangular, not peculiar; size .8 x .5 mm., rarely 1.0 x .6 mm.

Stage I.—Highest in front at first, later higher in the middle and more rounded, truncate before, tail rounded. Spines as in *T. pallida*, but smaller, distinctly alternating, the Y-shaped spines of joints 5, 7, 9 and 11 leaning out sometimes so much so that those of joints 7 and 9 lean at 90° and those of joints 5 and 11 at 45° with the erect ones on the strong segments. The anterior limb of the Y-spines has a tendency to be shorter, especially on the weak segments, where, as on joint 11, it may be scarcely more than half as long as the other and lack the cleft tip. Tips bifid or trifid, brown, narrowed just before

* In the long series of bred *flexuosa-cæsonia* from the collection of the late Mr S. L. Elliot, occurs a single specimen of *shurtleffii*, showing that he, too, had confused the larvæ.

the apex, the shaft of the spine pale. Color whitish, no marks except a large brown cervical shield. Head pale, eye black, mouth brown. Skin smooth as usual. Length .8–1.2 mm. Duration of the stage seven days.

Stage II.—Elongate elliptical, joint 3 truncate before, tail broadly square, scarcely notched at the sides. Dorsum and sides moderate, not distinctly concave, nearly flat. Subdorsal ridge segmentarily tubercular with large, low, round tubercles, bearing two short, blakc setæ, alternating, the tubercles of joints 5, 7 and 9 a little tipped outward. Lateral ridge not tubercular, gently waved segmentarily. Both ridges broadly covered with nearly contiguous granules, produced with pale slender spines, several from a granule; on the apices of the tubercles and edge of the lateral ridge these spines are usually dark and distinctly seen, under a high power, to be arranged in the form of a radiating crown of 4 to 6 around an erect central spine (Plate XI, Fig. 5). Dorsal and lateral spaces centrally nearly smooth, the granules feebly developed. Depressed spaces indicated, slightly sunken, not fully differentiated and protected between the setose ridges. Color whitish, faintly tinged with green; dorsum darker from the food showing by transparency. Length, 1.2–1.9 mm.

Stage III.—Elliptical, not much elongated, tail rounded, quadrate, distinctly notched at the sides. Dorsum slightly, lateral space distinctly concave, subventral space very small and retracted. Subdorsal ridge prominent, segmentarily beaded tubercular. Both ridges with short, distinct black primary setæ. Depressed spaces rather large and distinct, especially (1) and (4), the other small ones visible in a good light, none very sharply edged. Skin granules large on the tubercles, bearing a crown of minute black spines, losing these and grading off into smaller granules on the latticed ridges. The paler spines on these ridges may be seen in favorable lights to overhang the edges of the depressed spaces like minute fur. Lateral ridge weakly segmentarily waved with single setæ at the projections. The latticed ridges are broad, several granules wide, the depressed spaces finely granular in the bottom. Color frosted whitish, opaque, no marks; later all faintly bluish-green from the blood, still without marks; still later a narrow yellow subdorsal line appears in a series of dots on joints 4 to 10, free, or connected by a short bar on joint 8, either yellow or pinkish red. The brown rosette spines on the ridge give a shade along all the ridges and joining at the ends. Length, 1.8–2.8 mm.

Stage IV.—Elliptical, tail rounded quadrate, in general as *T. pallida*; ridges, especially the sub-dorsal, slightly segmentarily waved. Depressed spaces deep, well marked with perpendicular sides. Skin on the latticed ridges shortly, finely, densely white pubescent with minute colorless fur arising in a crown from each small granule. On the ridges the fur is usually dark, but it may be pale and concolorous with the rest. Granules nearly uniform on all the latticed ridges, which are at least four granules wide. Depressed spaces (1) to (8) present, (7) and (8) partly confluent obliquely. Color light yellowish-green, sparsely pigmented in patches dorsally and in the upper half of lateral space, the ridges clearer. A narrow wavy yellow sub-dorsal line on joints 4 to 13, often appearing double at a certain angle by the refraction of the distinct clear ridge, the pair connected by a narrow crimson bridge on joint 8, varying in different examples. A faint yellow or salmon colored transverse band on the anterior edge of joint 3, shaded dusky by the dark rosette spines. Sides paler green, depressed spaces darker, without colored centers. Head green, width about .5 mm. Length, 2.6–4.0 mm.

Stage V.—Elliptical, tail rounded, slightly notched at the sides; dorsal space about half as broad as the lateral one, flat; lateral space steep above, slightly concave; subventral small, retracted; the larva is therefore flattened. Subdorsal ridge indicated by the angular change in direction between back and sides; lateral ridge prominent. Depressed spaces fairly large, distinct. Latticed ridges rounded, the sides not always perpendicular. The skin looks smooth, minutely granular, even shining a little; but under a high power the 4 to 6 rosette spines are still seen on the granules, very short and pale. The granules are small, rounded, not quite contiguous, uniform all over, the narrowest latticed ridge four granules wide. The rosette spines are dusky on the anterior edge of joint 3. Color bright yellow green, rather translucent on the edges. The yellow subdorsal lines extend from joint 3 posteriorly to joint 13 anteriorly, narrowed at the addorsal depressed spaces, slender, not reaching the extremities. A yellow band on joint 3 anteriorly, shaded with crimson below. Depressed space (4) yellow in the base with a green center. Subdorsal lines free at the ends, a yellow bridge centrally, varying in different examples. It may become broad, covering joints 7–9, containing a round red spot on joints 7–8, scarcely even widening the subdorsal line. Length, 3.8–5.7 mm.

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... OF ARANEÆ TAKEN IN FRANCONIA, NEW HAMPSHIRE.

BY ANNIE TRUMBULL SLOSSON.

... spiders, taken by me during the last five years in Franconia, ...been examined and identified by Mr. Nathan Banks. There ...pecies in the list:

DRASSIDÆ.

...ntana *Em.*
...micoides *Bks.*
...nspersa *Thor.*
...rumalis *Thor.*
...arvula *Bks.*
Drassus neglectus *Keys.*
Prosthesima atra *Htz.*
Prosthesima ecclesiastica *Htz.*
Pythonissa imbecilla *Keys.*
Pœcilochroa montana *Em.*

CLUBIONIDÆ.

...nadensis *Em.*
...botti *Koch.*
...paria *Koch.*
...assipalpis *Em.*
...vittata *Keys.*
Thargalia pinnata *Em.*
Agrœca pratensis *Em.*
Phrurolithus pugnatus *Em.*
Phrurolithus alarius *Htz.*

AGALENIDÆ.

...vea *Htz.*
...erhami *Scop.*
Cicurina creber *Bks.*
Hahnia agilis *Keys.*

DICTYNIDÆ.

...lata *Htz.*
...idea *Em.*
...ima *Bks.*
Dictyna volucripes *Keys.*
Dictyna foliacea *Htz.*
Amaurobius ferox *Koch.*

THERIDIIDÆ.

...pidariorum *Koch.*
...ferens *Em.*
...punctatum *Em.*
...
Tmeticus, n. sp.?
Erigone persimilis *Cambr.*
Linyphia mandibulata *Em.*
Linyphia communis *Htz.*
Linyphia marginata *Koch.*
Linyphia phrygiana *Koch.*
Linyphia variabilis *Bks.*
...phantes minuta *Blk.*
...phantes nebulosus *Sund.*
...is *Blk.*
... *Blk.*
... *Reuss.*
... *Em.*

Stage VI.—Shape as described. Absolutely smooth, finely clear granular, the granules low, rounded, contiguous, but not appressed, without a trace of the rosette spines. Depressed spaces rather small, but sharp, the latticed ridges not less than five granules wide. Spaces very finely granular in the bottom; (1) flat before, with green glandular center, (2) rounded, highest in the center, (4) elongate. Pale yellowish-green, shading to nearly colorless on the lateral ridge, the dorsum and upper part of lateral area on joints 6 to 11 distinctly spotted with emerald green pigment. A narrow yellow sub-dorsal line, straight, but slightly crinkly edged, on joints 4 to 13, the pair free and uniform (Plate XI, Fig. 10), or partly or wholly connected by a yellow bridge, usually with a small red spot (Plate XI, Fig. 8), or rarely a rather large one covering joints 7 and 9 and widened on joint 8 (Plate XI, Fig. 9). The red spot varies in color from vermilion red to light blue or dark slaty blue, edged with crimson. On joint 3 in front, a transverse yellow line, edged with crimson below. A series of red spots usually appears, beginning on the collar in front and extending to joint 5, not discoloring the dorsal depressed spaces. The spots are dull and diffuse. At the end of the stage the pigment is all dissolved and the larva appears entirely transparent, dirty whitish or waxy greenish, the internal organs visible in motion. It eats for only a short time in this condition, and leaves the twig to spin. Length, 4.8–8.2 mm., in some large larvæ suddenly increased to 13.3 mm. at the end of the stage by the degenerative change in shape accompanying the loss of the pigment.

Cocoon as usual, elliptical, very small. The larvæ do not leave the tree, but spin in the crevices of the bark.

Food plants. Black oak, chestnut, beech, iron wood.

EXPLANATION OF PLATE XI.

Fig. 1. Larva, stage I, side view enlarged.
" 2. Two of the Y shaped setæ more enlarged.
" 3. Young larva, stage III, dorsal view.
" 4. A section of the skin granules, back and sides, stage III more enlarged.
" 5. A single skin granule with rosette spines, top and side views.
" 6. Mature larva, front view.
" 7. The same side view.
" 8. The same, dorsal view, the usual colorational form.
" 9. The same, showing the largest red spot seen.
" 10. The same, showing the absence of the red spot.
" 11. Moth of *Heterogenea shurtleffii* ♂, suffused form.
" 12. The same, ♀, normal form.

LIST OF ARANEÆ TAKEN IN FRANCONIA, NEW HAMPSHIRE.

BY ANNIE TRUMBULL SLOSSON.

These spiders, taken by me during the last five years in Franconia, have all been examined and identified by Mr. Nathan Banks. There are 147 species in the list:

DRASSIDÆ.

Micaria montana *Em.*
Micaria formicoides *Bks.*
Graphosa conspersa *Thor.*
Graphosa brumalis *Thor.*
Graphosa parvula *Bks.*
Drassus neglectus *Keys.*
Prosthesima atra *Htz.*
Prosthesima ecclesiastica *Htz.*
Pythonissa imbecilla *Keys.*
Pœcilochroa montana *Em.*

CLUBIONIDÆ.

Clubiona canadensis *Em.*
Clubiona abbotti *Koch.*
Clubiona riparia *Koch.*
Clubiona crassipalpis *Em.*
Thargalia bivittata *Keys.*
Thargalia pinnata *Em.*
Agrœca pratensis *Em.*
Phrurolithus pugnatus *Em.*
Phrurolithus alarius *Htz.*

AGALENIDÆ.

Agalena nævea *Htz.*
Tegenaria derhami *Scop.*
Cicurina creber *Bks.*
Hahnia agilis *Keys.*

DICTYNIDÆ.

Dictyna sublata *Htz.*
Dictyna frondea *Em.*
Dictyna maxima *Bks.*
Dictyna volucripes *Keys.*
Dictyna foliacea *Htz.*
Amaurobius ferox *Koch.*

THERIDIDÆ.

Theridium tepidariorum *Koch.*
Theridium differens *Em.*
Theridium sexpunctatum *Em.*
Theridium rupicola *Em.*
Steatoda borealis *Htz.*
Steatoda marmorata *Htz.*
Lithyphantes corollatus *Linn.*
Euryopsis funebris *Htz.*
Diopœna nigra *Em.*
Argyrodes trigonum *Htz.*
Ceratinella minuta *Em.*
Ceratinella fissiceps *Cambr.*
Ceratinella micropalpus *Em.*
Tmeticus, n. sp.?
Erigone persimilis *Cambr.*
Linyphia mandibulata *Em.*
Linyphia communis *Htz.*
Linyphia marginata *Koch.*
Linyphia phrygiana *Koch.*
Linyphia variabilis *Bks.*
Lepthyphantes minuta *Blk.*
Lepthyphantes nebulosus *Sund.*
Helophora insignis *Blk.*
Drapetisca socialis *Blk.*
Diplostyla nigrina *Reuss.*
Bathyphantes zebra *Em.*

Ceratinella emertoni *Cambr.*
Ceratinella pygmæa *Em.*
Ceratinopsis nigriceps *Em.*
Cornicularia directa *Cambr.*
Lophocarenum floreus *Cambr.*
Tmeticus plumosus *Em.*
Bathyphantes alpina *Em.*
Bathyphantes bihamata *Em.*
Micronecta 5-dentata *Em.*
Micronecta olivacea *Em ?*
Micronecta discolor *Em.*

EPEIRIDÆ.

Epeira solitaria *Em.*
Epeira corticaria *Em.*
Epeira cavatica *Keys.*
Epeira nordmanni *Thor.*
Epeira silvatica *Em.*
Epeira sclopetaria *Clerck.*
Epeira patagiata *Koch.*
Epeira strix *Htz.*
Epeira trifolium *Htz.*
Epeira insularis *Htz.*
Epeira trivittata *Keys.*
Epeira pratensis *Em.*
Epeira displicata *Htz.*
Epeira prompta *Htz.*
Epeira placida *Htz.*
Epeira gibberosa *Htz.*
Plectana stellata *Htz.*
Singa variabilis *Em.*
Singa maculata *Em.*
Cyclosa conica *Pall.*
Zilla montana *Koch.*
Cercidia prominens *West.*
Argiops transversus *Em.*
Larinia borealis *Bks.*
Meta menardi *Latr.*
Theridosoma gemmosum *Koch.*
Pachygnatha brevis *Em.*
Tetragnatha grallator *Htz.*
Tetragnatha extensa *Linn.*

THOMISIDÆ.

Xysticus stomachosus *Keys.*
Xysticus emertoni *Keys.*
Xysticus elegans *Keys.*
Xysticus limbatus *Keys.*
Xysticus 4-lineatus *Keys.*
Xysticus galosus *Keys.*
Xysticus triguttulus *Keys.*
Xysticus gramineus *Em.*
Xysticus formosus *Bks.*
Coriachne versicolor *Keys.*
Oxyptila conspurcata *Thor.*
Synæna obscura *Keys.*
Misumena vatia *Clerck.*
Tmarsus caudatus *Htz.*
Tibellus oblongus *Walck.*
Thanatus rubicundus *Keys.*
Philodromus rufus *Walck.*
Philodromus vulgaris *Htz.*

LYCOSIDÆ.

Lycosa pratensis *Em.*
Lycosa frondicola *Em.*
Lycosa erratica *Htz.*
Lycosa carolinensis *Htz.*
Pardosa montana *Em.*
Pardosa pallida *Em.*
Pardosa nigripalpis *Em.*
Pardosa brunnea *Em.*
Pirata minuta *Em.*
Pirata insularis *Em.*
Pirata montana *Em.*
Pirata, n.sp.?
Trochosa rubicunda *Keys.*
Ocyale undata *Htz.*
Dolomedes tenebrosus *Htz.*
Dolomedes scriptus *Htz.*
Dolomedes sexpunctatus *Htz.*

ATTIDÆ.

Phidippus rufus *Htz.*
Phidippus mystaceus *Htz.*
Phidippus borealis *Bks.*
Philæus militaris *Htz.*
Dendryphantes octavus *Htz.*
Icius elegans *Htz.*
Icius similis *Bks.*
Neon nellii *Peck.*
Habrocestum coccatum *Htz.*
Habrocestum decorum *Blk.*
Habrocestum borealis *Bks.*
Habrocestum cristatum *Htz.*
Ergane borealis *Blk.*
Saitis pulex *Htz.*
Attus palustris *Peck.*
Attus cruciatus *Em.*
Zygoballus iridescens *Bks.*

DESCRIPTIONS OF SOME LEPIDOPTEROUS LARVÆ.

BY D. W. COQUILLETT.

Nola miniuscula *Zell.*

Body light bluish-green or light gray, on each of the segments four to eleven is a transverse row of four very large brownish warts, which are thinly covered with short whitish hairs, while below the lowest of each, and on 1, 2, 3 and 12 segments is a smaller greenish or gray wart thinly covered with longer white hairs; a subdorsal wavy black line on anterior part of body, sometimes extending nearly the entire length of the body; head small, wholly contractile in the first segment, light brownish, a black dot on each side, spiracles wholly brown; fourteen legs, none under segment six. Length, 12 mm.

Found one June 9th and three June 11th, 1886, feeding upon a Tenthridinid gall on willow; they feed upon them from the outside. Two spun whitish, elongate-ovate, tough cocoons June 12. The date of the issuing of the moths was not noted.

Scepsis wrightii *Grote.*

A caterpillar pupated December 14, 1889, and the moth issued February 11 of the following year. The chrysalis is pale yellowish, marked with a dorsal, lateral and ventral broad black interrupted band and a subdorsal row of black dots. Another caterpillar pupated February 18, 1890, and the moth issued March 21, of the same year.

Arctia nevadensis *Grote.*

Body black, with a purplish tinge, the portion below the spiracle lighter, more grayish; a broken dull white dorsal line; warts light gray, hairs issuing from them in spreading clusters not concealing the ground color, mixed black and reddish, or black and yellowish, the red and yellow hairs most numerous in the middle of the dorsum and low down on each side of the body, and varying in color from a bright brick-red to a pale straw-yellow; spiracles yellowish-brown, ringed with black; head black, the sulcus on top between the two lobes, usually the sides and lower margin of the clypeus and a dot at the base of each antennæ, yellow, mouth parts marked with yellow, anal and abdominal prongs largely pale yellowish. Length, 36 mm.

Found a great many from one-half to nearly full grown feeding upon various plants at Santa Monica, California, March 14, 1891. Placed leaves of *Malva borealis* in their cage, and they fed greedily upon them. One moth issued July 29; at this date there were two chrysalids and ten larvæ; the remaining moths issued in August and September. All the moths bred had the black thorax.

Hemileuca electra *Wright.*

Body black, thickly dotted with white; an indistinct broken black dorsal line bordered by a white line; a yellowish or white subdorsal and two stigmatal lines, one of the latter above and the other below the spiracles; spines short, in thin spreading clusters, those in the two dorsal rows simple except on segments one and two, in the other rows a branched spine arises from the middle of each cluster, each branch terminating in a long slender bristle; body thinly covered with short stiff white hairs, not concealing the ground color; head shining black, thinly covered with short stiff white hairs; space between the two stigmatal lines less dotted with white than the remainder of the body; sutures more or less brownish; spiracles brown, ringed with black. Length, 45 mm.

Found several on *Eriogonum fasciculatum* on a high hill near Riverside, California, April 12, 1887. One pupated May 8, and the moth issued November 1, of the same year.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF DECEMBER 21, 1897.

Held at the American Museum of Natural History.

President Palm in the chair. Ten members and several visitors present.

The resignations of Messrs. Pike and Küchler were read and accepted.

Mr. Groth moved that the President appoint a committee to propose names for the officers for 1898. Accepted. Messrs. Beutenmüller, Zabriskie, Groth and Daecke were appointed to serve on this committee.

Mr. Shoemaker read a paper on "Sugaring for Moths," in which he stated that he had collected during the past summer at Aqueduct, Long Island, from June 16th to October 16th, and that he had taken 118 species of Noctuidæ on 26 trips, and amongst which were species of *Agrotis*, *Tæniocampa*, *Scopelosoma*, *Cucullia*, *Plusia*, *Hadena*, *Mamestra*, etc. His method of collecting was to suspend dried apples that had been strung on a copper wire and soaked in the sugaring mixture. These were hung on bushes and small trees along thickets. While the usual bait of beer, molasses and rum was attractive to the moths, he found that adding a little asafœtida rendered the mixture still more attractive, and that the moths would prefer this mixture to the former. He stated that weather conditions most favorable to collect in were clear, dark nights with a light breeze, and that it made no difference if it was warm or cold. There were few moths flying on moonlight nights. During the summer he spent several days collecting in the same locality for Lepidoptera and took *Argynnia idalia*, *Pamphila pontiac*, *Chrysoph. thoë*, *Neonympha canthus*, *Acontia delecta*, *Doryodes bistriaris*, *Cilla distema*, and also pupæ of *Hydrœcia necopina* in stalk of wild sunflowers.

Mr. Blackburn, exhibited a book of butterflies, which proved a novel way of mounting them. He explained that by taking some paper slightly gummed and pressing the wing between two pieces, all the scales would adhere to the paper and by painting in the body of the insect in its proper place, a perfect representation of the insect could be obtained. After discussion, adjournment.

MEETING OF JANUARY 4, 1898.

Held in the American Museum of Natural History.

President Palm in the chair. Twelve members present.

The Treasurer's Annual Report was read, approved and referred to the Auditing Committee.

The following officers for 1898 were elected. President, Dr. E. G. Love; Vice-President, G. F. Groth; Treasurer, L. H. Joutel; Recording Secretary, E. Daecke; Corresponding Secretary, Ernest Shoemaker; Executive Committee, Messrs. Zabriskie, Palm, Daecke, Hug, and Dr. Ottolengui; Publication Committee, Messrs. Beutenmüller, Joutel, Schaeffer and Groth.

Rev. Zabriskie exhibited a small Proctotrypid Hymenopteron, *Dryinus*, sp., with chelate anterior tarsi. He referred to the fact of the Hymenoptera being in general beneficial to man, because of their preying, as captors or parasites, upon injurious insects; the Proctotrypidæ being especially beneficial as parasites upon the

smaller insects, and largely upon insect eggs. The Dryinæ are said to confine their attacks to small hymenopterous insects such as Jassidæ, etc., and to live in small felt-like sacks protruding from the abdominal spiracles of the host. A curious feature found only in this one sub-family of hymenoptera, is that of the chelate anterior tarsi of the females. These chelæ are formed somewhat on the plan of the formidable pincers of the lobster, although relatively more slender. They are outgrowths from the inner side of the fourth tarsal joint and are of comparatively large size, so that when opened in a straight line, the expanse is nearly equal to the combined length of all five tarsal joints; when the two members of pincers are closed together, the lid is folded upward against the inner side of the first, second and third tarsal joints. They are probably used for holding the prey when the female is ovipositing.

Mr. Beutenmüller showed a number of remarkable Australian Hepialids from Mr. Schaus' collection; among which were *Zelotypia stacyi*, *Hepialus virescens*, *H. swainsonii*, *H. daphnandræ*, *H. eximia*, *H. splendens*, *H. lignivorus* and *H. lewinii*.

Mr. Joutel spoke on the protective habit of *Cotalpa lanigera*. He stated that the beetle, which is bright yellow and a very conspicuous object, has the habit of drawing the edges of the leaves together with its claws, so that it is completely hidden. Several may be on the same bush, but from this habit not one will be seen. He also exhibited eggs of the common walking-stick. They very much resemble seeds, in color, size and shape. Adjournment.

MEETING OF JANUARY 18, 1898.

Held at the American Museum of Natural History.

President Dr. Love in the chair. Eleven members present.

The Auditing Committee reported on the Treasurer's accounts as being correct.

Dr. Ottolengui spoke on the genus *Plusia* and pointed out the relative differences and doubtful nomenclature of various species of this genus.

MEETING OF FEBRUARY 1, 1898.

Held at the American Museum of Natural History.

President Dr. Love in the chair. Twelve members and several visitors present, amongst which were Professor Smith, Messrs. Southwick and Ormond.

Mr. Joutel proposed Mr. W. T. Davis for membership.

The President appointed Messrs. Zabriskie, Palm and Beutenmüller, to form an auditing committee for 1898, and Messrs. Loss and Munch as the field committee.

Mr. Crampton spoke upon experiments upon the grafting of pupæ of Lepidoptera. He described in detail a series of experiments upon pupæ performed during the spring of 1897. These experiments, he added, were similiar to those made by Dr. Born upon the coalescence of portions of different embryos of Amphibia. Besides the possibility of coalescence of two individuals or parts of individuals, there appeared in the Lepidoptera experiments certain other interesting problems, which related chiefly to the causes producing the magnificent colors of the imago. From the work of Mayer and others it has been shown that the pigmented colors are produced by the chemical decomposition of the hæmolymph in the empty scale cells. Hence, *a priori*, it might be possible to produce reciprocal color effects of one moth upon another differently colored moth by uniting the hæmolymph of each with that of the other. The problem of heredity involved in such cases, as *C. promethea* where the male and female

are of different colors is the question whether the gonad of a certain sex and the color, are both the effects of a common set of causes, or whether the color is more directly dependent upon the gonad of a certain sex. As the color is produced by a chemical decomposition of the hæmolymph, and as the hæmolymph can hardly escape being reciprocally affected chemically by the sexual organs, the second of the assumptions would be indicated.

The results so far obtained, however, do not warrant any final opinion upon this subject. The pupæ used were those of the common Saturnidæ, *Callosamia promethea*, *Platysamia cecropia* and *Telea polyphemus*. A cartilage knife or razor was used in cutting the pupæ. The two portions to be united were placed in apposition and melted parafine was applied with a camel's hair brush to the edges of the common wound. The cooled parafine formed a ring which kept the parts together and prevented the escape of the hæmolymph. Three groups of operations were recognized according to the make-up of the complex. First, where parts from two different pupæ were united in normal proportions.

Homoplastic operations upon *Cynthia* furnished three successful cases. Only one heteroplastic union was obtained. In this specimen a part of the abdomen of a female *promethea* was united to the rest of the body of a *cynthia*. The part of the imago derived from the *promethea* showed no trace of a red color, but was buff, the ground color of the *cynthia*. "Tandem" fusions formed the second group. In these a head was cut from one pupa and a part of the abdomen of the other, the parts being united on a long axis. The resulting moths possessed four pairs of wings and six pairs of legs. Heteroplastic and homoplastic.

Twin unions formed the third group. In these but little of each pupa was cut off. Moths joined by the heads, by their backs or tails or sides could be produced by corresponding operations. In some of the heteroplastic unions, however, was there any indications of reciprocal color effects.

In summary it was pointed out that homoplastic unions were easier to produce than heteroplastic ones. Eleven per cent. of the latter was successful, while fifteen per cent. of the former furnished imagines. The mortality was greatest among the pupæ of the first group, only six surviving the operation. The "Tandem" give a percentage of success of eleven. The "Twins" furnished twenty per cent. of successful operations. He hoped that future operations and experiments will furnish data for the solution of the problem of reciprocal color effects. After a lengthy discussion the meeting adjourned.

Meeting of February 15, 1898.

Held at the American Museum of Natural History.

President Dr. Love in the chair. Eight members present and several visitors.

Mr. Davis was elected an active member.

Mr. Beutenmüller exhibited specimens of the curiously formed butterflies, *Armandia lidderdalii* and *A. thaidina*.

Mr. Joutel showed living specimens of *Ceruchus piceus* in decayed white birch. After discussion, adjournment.

Meeting of March 1, 1898.

Held at the American Museum of Natural History.

Vice-President Groth in the chair. Twelve members present.

Mr. Ditmars read a popular paper on the Transformations of Insects, and described in some details the main characteristics of the different orders. He also exhibited a series of prepared specimens of transformations preserved in alcohol and some anatomical models.

A brief note from Dr. Kunze on *Euchloë pima* was read by Mr. Beutenmüller. He stated that *pima* is single brooded and flies in Pima and Maricopa Co., Arizona, principally during March. Dr. Kunze took it also on February 28, 1898. *Pima* rifles the flowers of a hirsute plant called *Amsinckia spectabilis* and stated that he never observed it feeding on any other plants. It is difficult to differentiate between the sexes on the wing, as both are exactly alike in color. Besides the female is very scarce and about in proportion as 1 to 20.

Mr. Beutenmüller exhibited about 100 species of Sphingidæ from Mr. Schaus' collection. Amongst which were *Ambulyx substrigalis*, *A. rubicosa*, *Pterogon gorgonides*, *Salaspes infernalis*, *Maruba roseipennis*, *Amblypterus panopus*, etc.

MEETING OF MARCH 15, 1898.

Held at the American Museum of Natural History.

President Dr. Love in the chair. Fourteen members and visitors, Messrs. Kearfott and Southwick, present.

Mr. Southwick read a paper on the economic entomological work done in the parks of New York City.

He enumerated and described in detail the various insects and the modes of destroying them, the sc aping of the egg-masses and cocoons in winter and the spraying of the foliage in summer.

Mr. Southwick described the various emulsions for the destruction of insects, and stated that a mixture of London purple against the Elm beetle was very effective. The work against the beetle is begun about the middle of May by spraying and again about June 6th for their larvæ with an emulsion of soft soap, kerosene, carbolic acid and water. The various borers are treated with bisulphide of carbon. Fungi which promptly appear after trees have been wounded are scraped off and the affected places painted with celluloid. The bag-worm, *Thyridopteryx ephemeræformis*, formerly very abundant, has almost entirely vanished from the parks by effective work; similarly the scale-louse, *Pulvinaria innumerabilis*, formerly common in the parks, has almost entirely disappeared from that place. The speaker pointed out the effective work which is constantly in progress against a number of other injurious insects, such as the *Orgyia*, different species of *Datana*, *Hyphantria*, oyster-shell bark louse (*Mytilaspis*) and different Hackberry Galls (*Pachypsylla*).

In conclusion the speaker showed a number of tools used for economic entomological work, such as knives, scrapers, spraying nozzles, etc.

Mr. Palm exhibited some rare Coleoptera collected by Dr. Kunze in Arizona.

Mr. Kearfott showed a box of inflated larvæ. After discussion adjournment.

MEETING OF APRIL 5, 1898.

Held at the American Museum of Natural History.

President Dr. Love in the chair. Ten members present.

Dr. Seifert spoke on experiments of heat and cold upon pupæ of Lepidoptera. He stated that larva exposed to an abnormal degree of heat or cold showed no visible

differences in the imago, pupæ, however, exposed to heat yield images of darker and more intense coloring, while such exposed to a longer period of abnormal cold will produce comparatively lighter effects. Excessive moisture causes a scarcity of scales and gives the wings a glassy semitransparent appearance. He exhibited a number of specimens produced by abnormal temperature.

Mr. Davis spoke on the dragonflies of Staten Island.

Mr. Beutenmüller exhibited a nest of *Vespa crabro* from Europe. This nest had evidently been built between the rafters of a house, being covered with a very brittle wood-pulp from which the resinous substance exuded, giving the nest a variegated appearance. Usually this species builds its nest in a hollow tree.

Mr. Groth exhibited a series of biological sets and transformations of Wasps. After discussion, adjournment.

MEETING OF MAY 3, 1898.

Held at the American Museum of Natural History.

Dr. Love in the chair. Ten members present.

Mr. Schaeffer made some remarks on the genus *Omus*, and exhibited *O. lecontei, edwardsii, sequoiarum, californicus, audouini, ambiguus* and *dejeanii*, all from the Museum collection.

Mr. Beutenmüller spoke on the genus *Euchloë* and pointed out that the American species may be placed into three groups according to venation, *Midea, Euchloë* and *Anthocharis*.

After discussion, adjournment.

MEETING OF MAY 17, 1898.

Held at the American Museum of Natural History.

President Dr. Love in the chair. Ten members present.

The publication committee reported that they discussed the expediency of holding an auction sale of insects for the benefit of the JOURNAL.

Dr. Love proposed the following amendment to the constitution and by-laws:

"*Resolved*, That Article XVI be amended by inserting the words '*and September*' after the word '*August*' and by the omission of the word '*and*' between the words July and August."

The resignation of Mr. Nushardt was read and accepted.

Mr. Dæcke gave some notes on *Thecla damon*, in which he stated that this creature had the habit of dropping to the ground when disturbed, and owing to its green and brown colors was difficult to detect amongst grass.

Mr. Beutenmüller, stated that the Museum collection of Coleoptera is now being arranged, and he estimated that it contained at least 150,000 specimens.

A general discussion of the species of *Cicindela* was held, after which followed adjournment.

MEETING OF JUNE 7, 1898.

Held at the American Museum of Natural History.

President Dr. Love in the chair. Eight members present and several visitors.

Mr. Beutenmüller announced a donation by Mr. Schaus of $50.00 to the JOURNAL fund and it was moved and accepted that the Secretary forward a letter of thanks to Mr. Schaus for this generous donation.

The amendment to the constitution and by-laws announced at the previous meeting was accepted.

Mr. Schaeffer proposed for active membership Messrs. Joseph E. Graef and F. A. Stinner.

A discussion on the species of the genera *Pamphila* and *Leptura* was held. Adjournment.

MEETING OF JUNE 21, 1898.

Held at the American Museum of Natural History.

President Dr. Love in the chair. Eight members present.

Messrs. Stinner and Graef were elected as members of the Society.

Mr. Beutenmüller proposed Mr. W. D. Kearfott for active membership.

After a discussion on various topics the meeting adjourned until October.

MEETING OF OCTOBER 4, 1898.

Held at the American Museum of Natural History.

President Dr. Love in the chair. Eight members present.

Mr. Kearfott was elected as member of the Society.

It was moved and accepted that a vote of thanks be extended to Mrs. A. T. Slosson for a number of rare *Lepidoptera* which she donated for the auction sale.

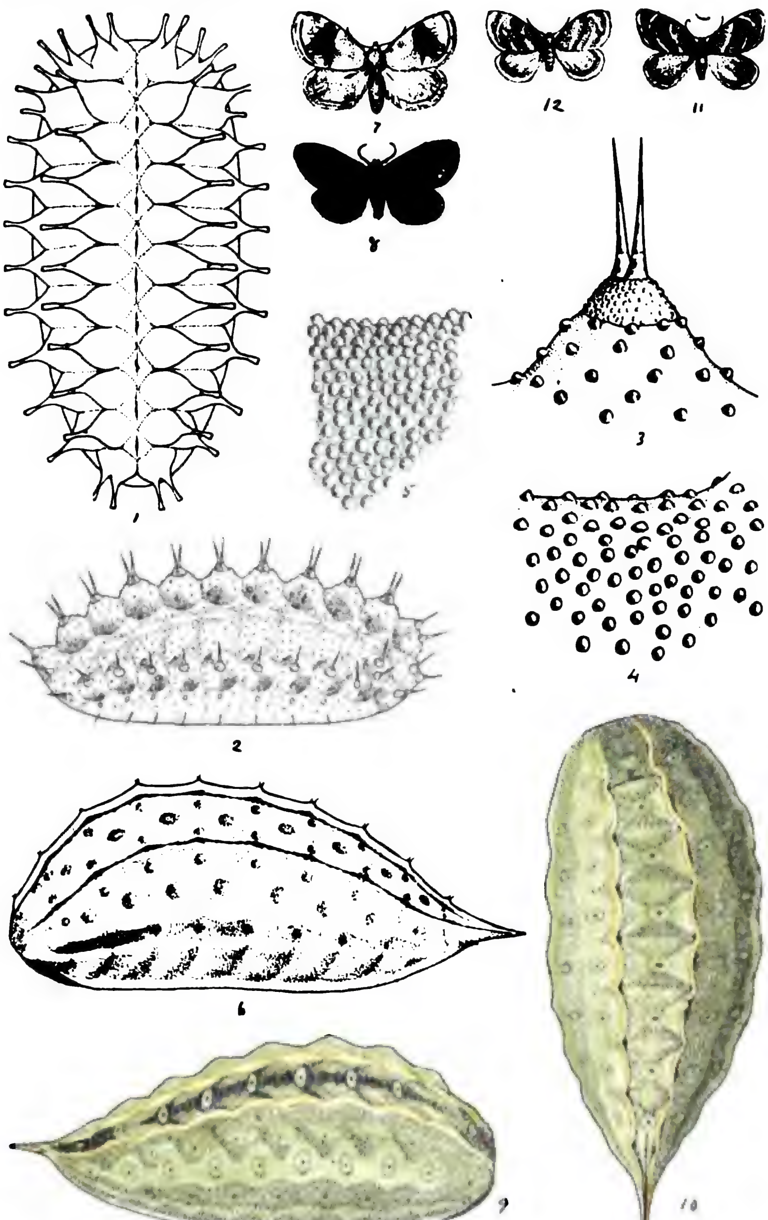
Mr. Joutel made some remarks on a curious variety of *Spilosoma latipennis* which had yellow forelegs. He stated that these were bred from eggs of a specimen which had pink forelegs, the normal form.

Mr. Beutenmüller spoke on the observations made by Dr. Seifert on three closely allied species of *Arctia—nais, phalerata* and *vittata*, and proved the validity of these three species.

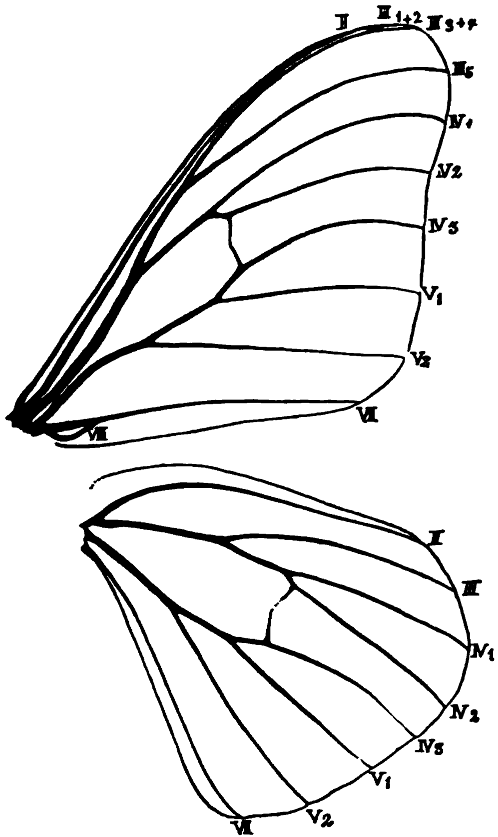
INDEX TO VOLUME VI.

ERRATA.

Page 45, for Eurinæxilis, sp. nov., read Eurina exilis, sp. nov.
Page 194, line 9, for immediate read immaculate.



Life-Histories of Packardia geminata and elegans.



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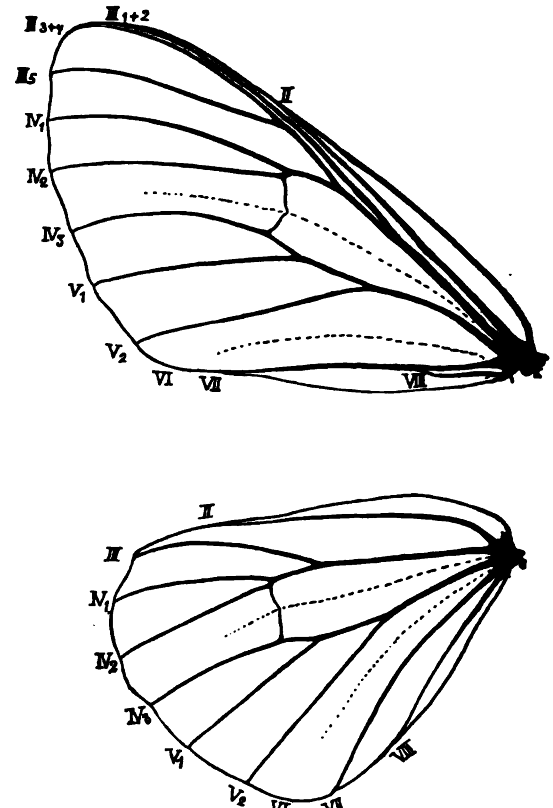

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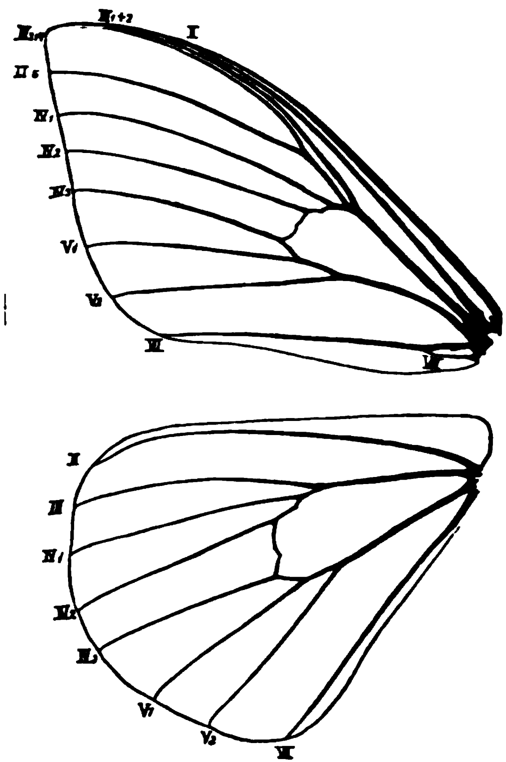
Classification of Lepidoptera.



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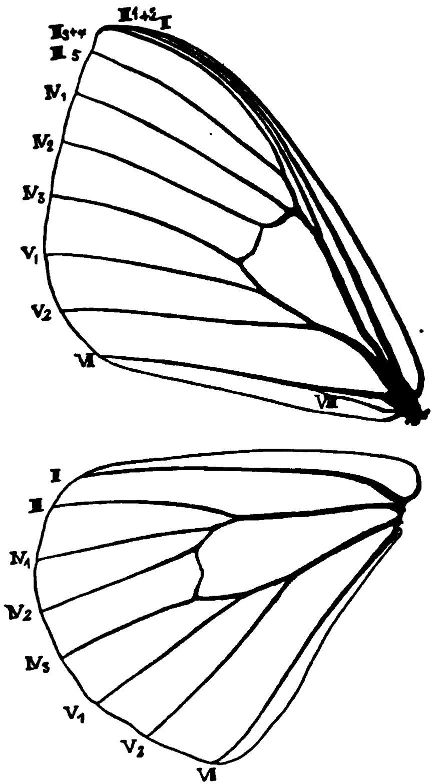

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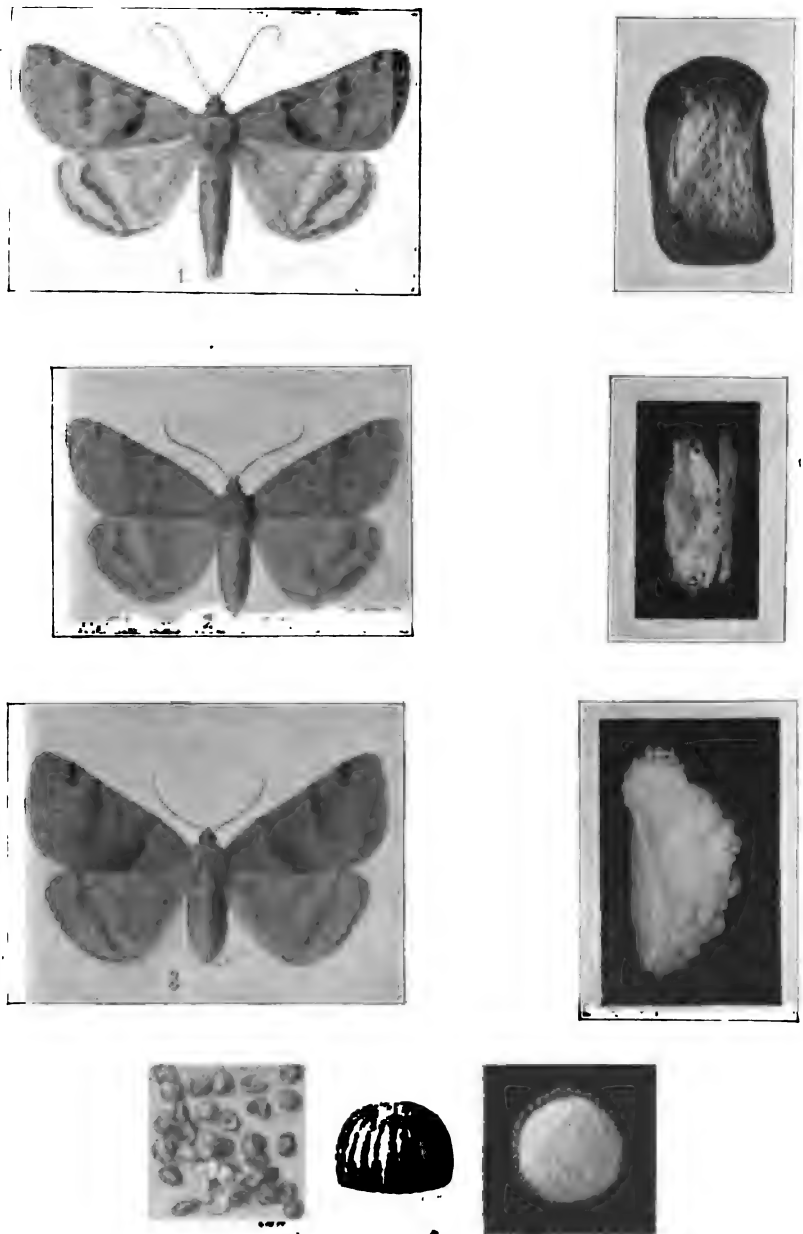
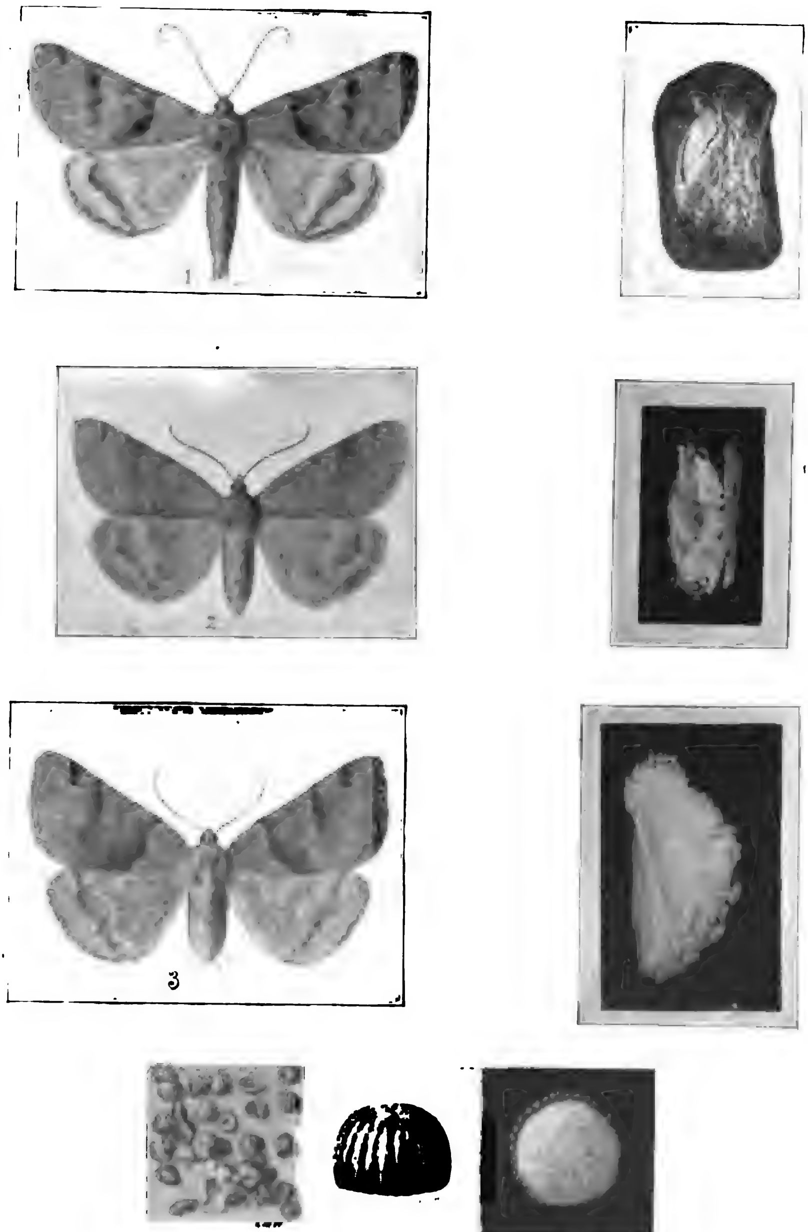
Classification of Lepidoptera.



Drasteria erechtea.



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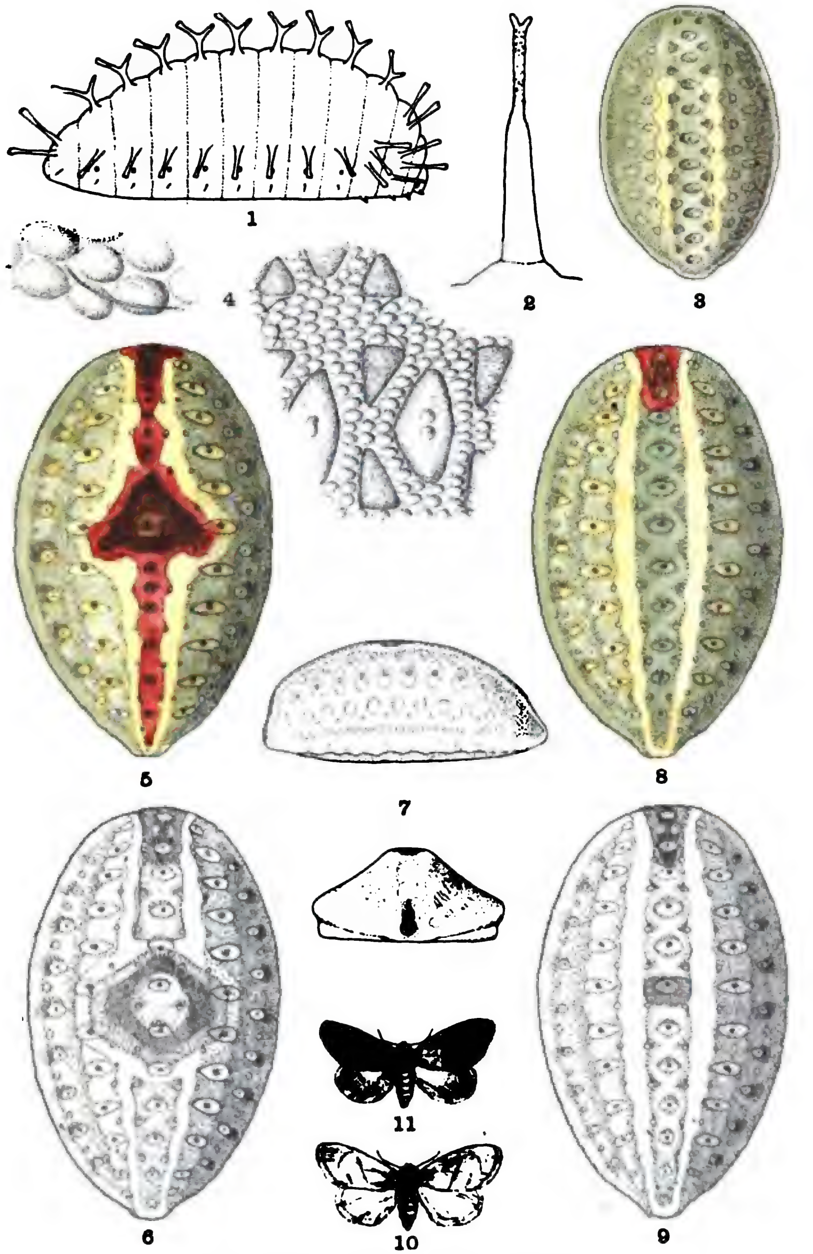
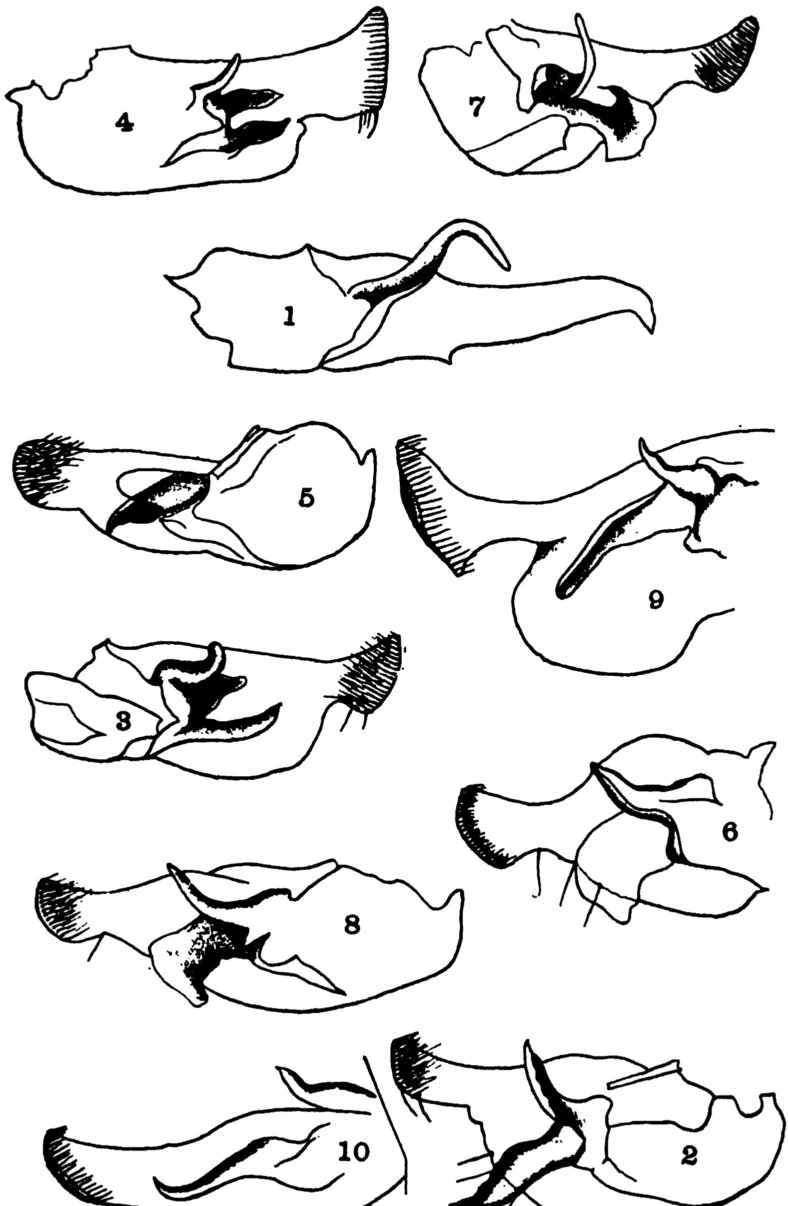
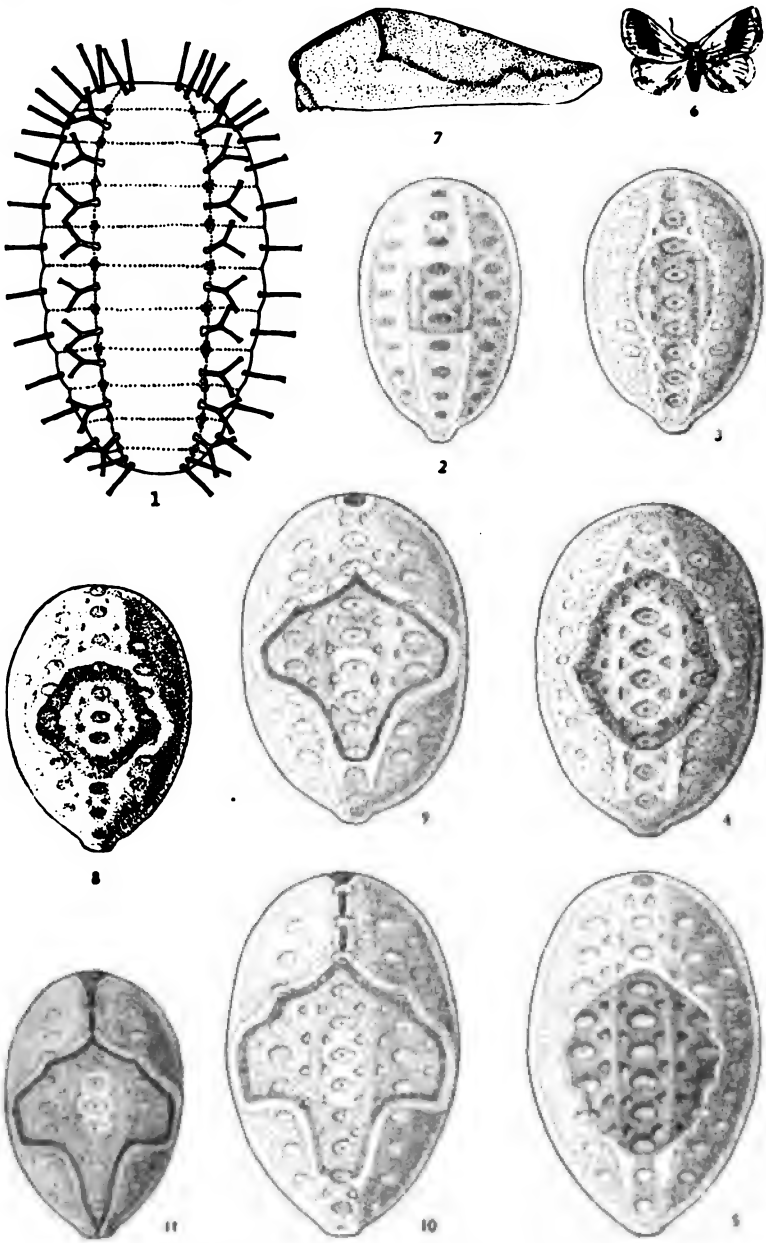


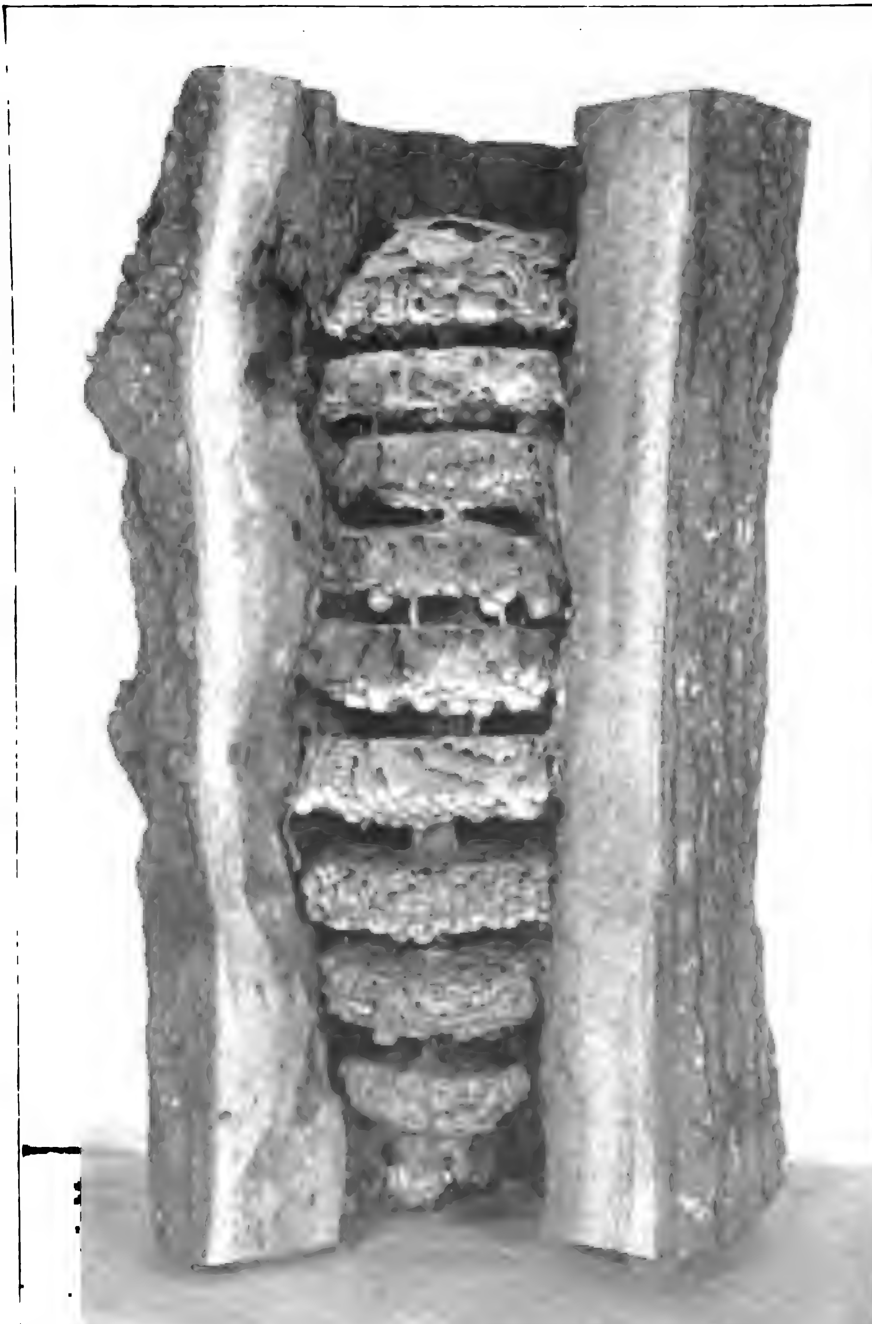
Life-History of Heterogenea flexuosa.



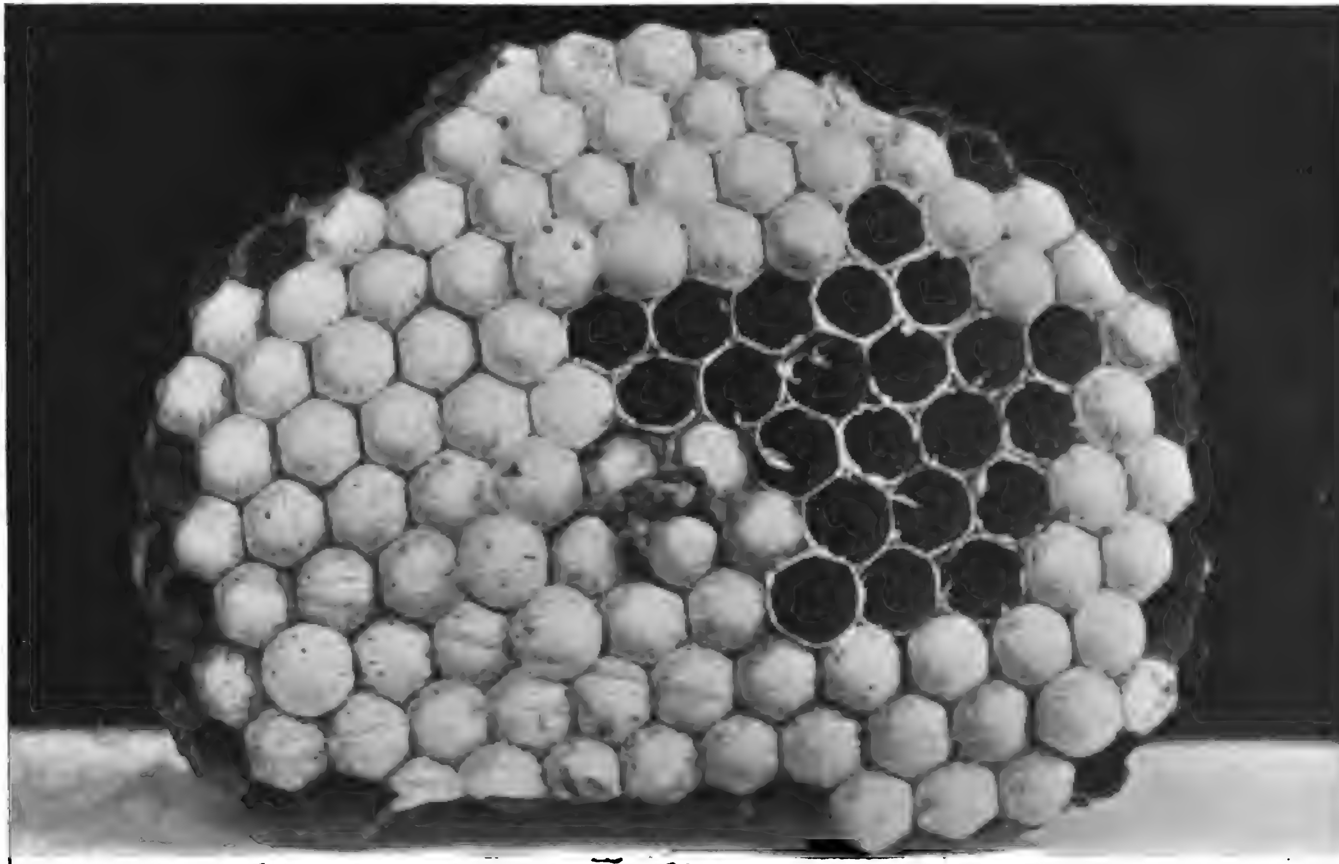
Genitalia of Noctuidæ.

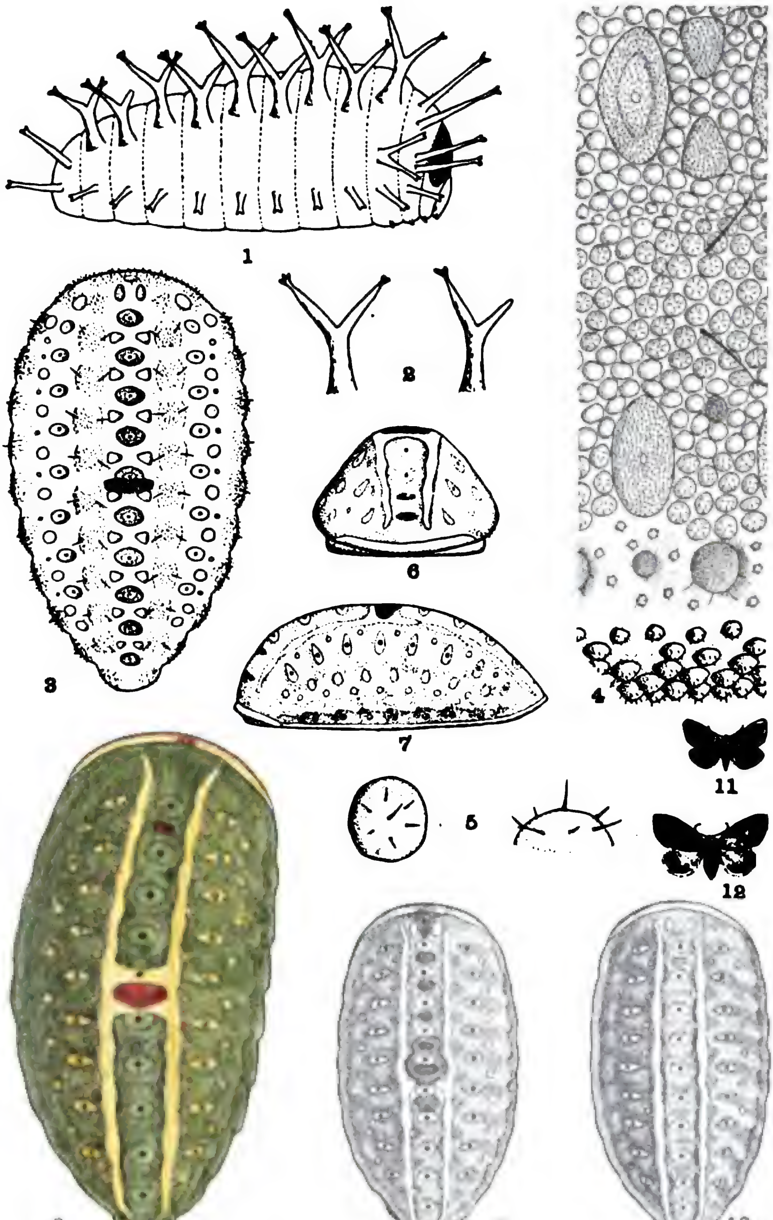


Life-History of Tortricidia testacea.



Nest of Vespa crabro.





Life-History of Heterogenea shurtleffii.